6.2.10 Front End Cap Replacement

Replacement Kit Number: S=332222; S-D= 332224; S/T= 332161; S/T-D= 332160

Repair Kit Contents	Tools Required
Front end cap (1) Hose clamps (2) Tie wrap (1)—S-D and S/T-D Front End Caps only 6-32 Latch-type fasteners (4)	Torque screwdriver set to 4 in-lb Needle nose pliers Cutting pliers for S-D and S/T-D only

Refer to Figures: 6-18, 6-19

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

NOTE: For units with serial numbers greater than 52000, complete Steps 2 to 5 of Section 6.2.21 before Step 2, but remove side panel "E" only.

Step 2 Remove the six Phillips head screws (A) that hold the front end cap (B) in place.

NOTE: The hose clamps ratchet together. Use a slotted screwdriver to open the clamp.

Step 3 Remove and discard the hose clamp from the flex connector (C).

NOTE: For units with serial numbers greater than 52000, Step 4 is unnecessary.

Step 4 Remove the remaining Phillips head screw (D) that retains the switch-side crossbar (E) and remove the crossbar.

CAUTION: Before you remove the switch wires from the main power switch, be sure to note their proper location and label them for reconnection.

Step 5 Disconnect the switch wire plugs (F) from the main power switch (G).

Step 6 Depress the mounting tabs on the top and bottom of the switch and push the switch out of the front end cap. You must re-use the main power switch.

Step 7 **For S-D and S/T-D models only** — cut the nylon tie wrap that holds the pressure port tube on the pressure port (H). Pull the tube off of the pressure port.

Step 8 Turn the unit upside down.

NOTE: For units with serial numbers greater than 52000, perform Steps 2 to 4 of Section 6.2.22 before Step 9.

Step 9 Remove and discard the hose clamp on the blower inlet port (I) and slide the bellows off the blower inlet port.

Step 10 Move the front end cap away from the unit.

Step 11 Locate the lot number label inside the old front end cap. Transfer any lot numbers on the old label to the appropriate lines on the label of the new front end cap.

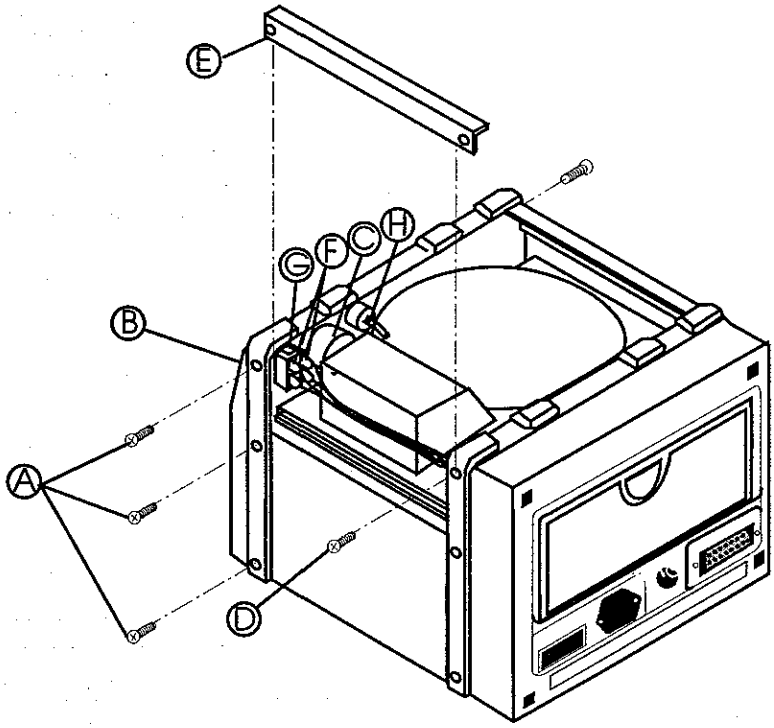


Figure 6-18

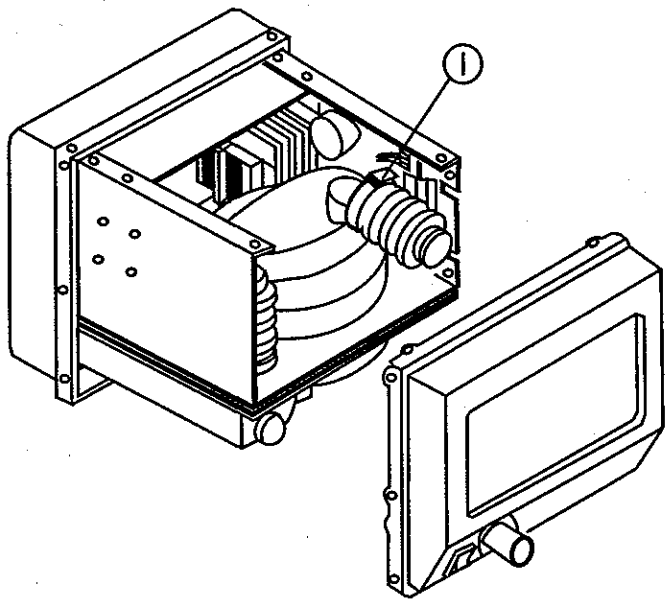


Figure 6-19

Reassembly:

Step 1 Place the new front end cap near the front of the unit. Place a new hose clamp over the inlet bellows and tighten it by one or two ratchets. Apply a fine mist of alcohol on the blower inlet port and slide the inlet bellows over the port. Tighten the hose clamp over the bellows and the inlet port.

NOTE: For units with serial numbers greater than 52000, perform Reassembly Steps 2 to 3 of Section 6.2.22 before proceeding to Step 2.

Step 2 Turn the unit right side up.

Step 3 Place a new hose clamp over the flexible connector and tighten it by one or two ratchets. Apply a fine mist of alcohol on the blower outlet port and slide the flexible connector onto the port. Tighten the hose clamp around the connector and blower outlet port.

Step 4 Push the main power switch into the front end cap. Be sure to orient the switch so that the "I" is on top and the "0" is on the bottom.

Step 5 Reconnect the switch wires to the power switch.

Step 6 **For S-D and S/T-D models** — push the pressure port tube onto the pressure port and tighten with a small nylon tie wrap.

Step 7 Align the six holes of the front end cap with the holes in the cross bars (side panels for serial numbers greater than 52000) and chassis. Replace and tighten the six Phillips head screws with the torque screwdriver set to 4 in-lb.

NOTE: For units with serial numbers greater than 52000, perform Reassembly Steps 1 to 3 in Section 6.2.20 before proceeding to Step 9.

Step 8 Replace the wraparound and feet.

Step 9 Perform the System Adjustment and Final Test procedures in Chapter 7 of this manual.

6.2.11 Blower Shock Mount Replacement

Replacement Kit Number: 332173

Repair Kit Contents	Tools Required
Blower shock mounts (4) Hose clamps (2) Tie wrap, ET-3 (1) 8-32 Locking nuts (4)	Torque screwdriver set to 4 in-lb Torque nut driver (11/32") set to 10 in-lb Needle nose pliers Cutting pliers Loctite 222

Refer to Figures: 6-20, 6-21, 6-22

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

NOTE: For units with serial numbers greater than 52000, perform Steps 2 to 5 of Section 6.2.21 instead of Step 2.

Step 2 Remove the four Phillips head screws (A) holding the two end cap cross bars (B) to the front (C) and rear (D) end caps. Rotate the cross bars slightly and lift them up and out of the unit.

CAUTION: The system tubing is held tightly on the connectors. Do not pull the tubes from side to side; use a straight, firm pull to break the seal. Label the tubes for proper reconnection.

Step 3 Note the position of the flow pick-up tubes (E), label them, and disconnect them from the top of the blower assembly.

Step 4 Turn the unit upside down.

NOTE: For units with serial numbers greater than 52000, perform Steps 2 to 4 of Section 6.2.22 before proceeding to Step 5.

NOTE: The hose clamps ratchet together. Use a slotted screwdriver to open the clamps.

Step 5 Remove and discard the hose clamp (F) on the blower inlet port (G) and slide the bellows off the blower inlet port.

Step 6 Turn the unit right side up.

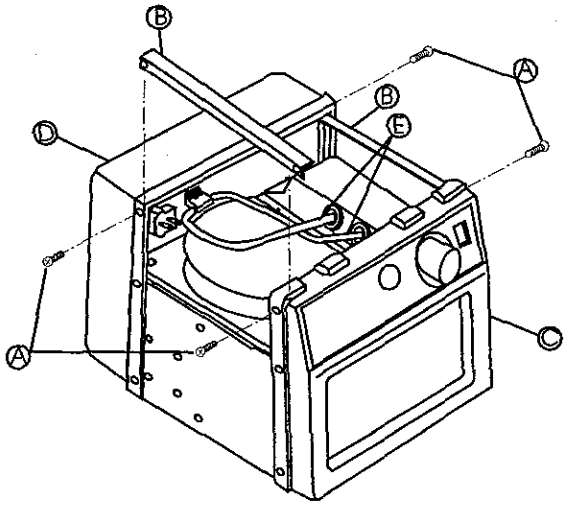


Figure 6-20

NOTE: The front end cap is shown detached for clarity only. It is not removed at this stage of disassembly.

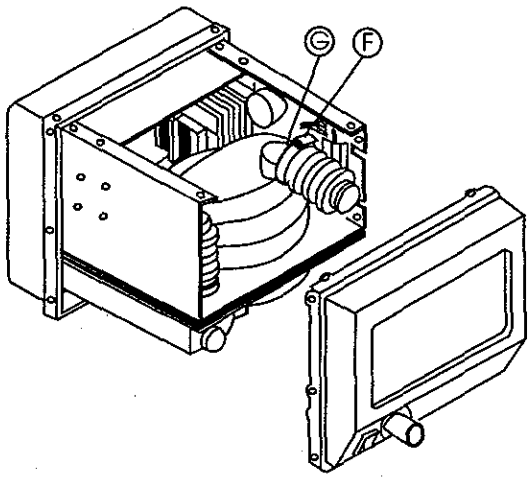


Figure 6-21

Step 7 Remove the remaining four Phillips head screws (H) that hold the front end cap in place.

NOTE: For units with serial numbers greater than 52000, the four screws (H) are already removed.

NOTE: The hose clamps ratchet together. Use a slotted screwdriver to open the clamp.

Step 8 Remove and discard the hose clamp from the flex connector (I).

Step 9 Move the front end cap out of the way.

Step 10 Remove the four Phillips head screws (J) that attach the rear end cap to the unit.

Step 11 Tilt the rear end cap away from the unit.

Step 12 With the nut driver, remove the four locking nuts (K) that hold the blower assembly to the rubber shock mounts.

Step 13 With the nut driver, remove the four locking nuts (L) that fasten the rubber shock mounts to unit.

Step 14 Carefully lift one side of the blower assembly and remove the two rubber shock mounts (M). Insert two new rubber shock mounts in their place.

Step 15 Repeat Step 14 for the opposite side of the blower assembly.

Reassembly:

Step 1 Replace and tighten the four 8-32 locking nuts that retain the rubber shock mounts on the unit. Use the torque nut driver set to 10 in-lb.

Step 2 Replace and tighten the four locking nuts that retain the blower assembly on the rubber shock mounts. Use the torque nut driver set to 10 in-lb.

Step 3 Replace the rear end cap and insert and tighten the two lower Phillips head screws on each side.

Step 4 Place a hose clamp over the flex connector, apply a light mist of alcohol on the blower outlet port, and slide the flex connector over the blower outlet port. Tighten the hose clamp over the connector and outlet port.

NOTE: For units with serial numbers greater than 52000, skip Step 5.

Step 5 Insert and tighten the four Phillips head screws that hold the front end cap to the unit. Use the torque screwdriver set to 4 in-lb.

Step 6 Turn the unit upside down.

Step 7 Place a hose clamp over the inlet bellows collar, apply a light mist of alcohol on the blower inlet port, and slip the intake bellows over the port. Tighten the hose clamp over the inlet port.

NOTE: For units with serial numbers greater than 52000, perform Reassembly Steps 1 to 3 in Section 6.2.22 before proceeding to Step 8.

Step 8 Turn the unit right side up.

Step 9 Reconnect the pressure port tube to the pressure port. Secure the connection with a nylon tie wrap.

Step 10 Reconnect the flow pick-up tubes to the top of the blower assembly.

Step 11 Reconnect the power switch wires to the main power switch.

NOTE: For units with serial numbers greater than 52000, perform Reassembly Steps 1 to 5 in Section 6.2.21 in place of Step 12.

Step 12 Replace the front-rear cross bars.

Step 13 Replace the wraparound and feet.

Step 14 Perform the System Adjustment and Final Test procedures in Chapter 7 of this manual.

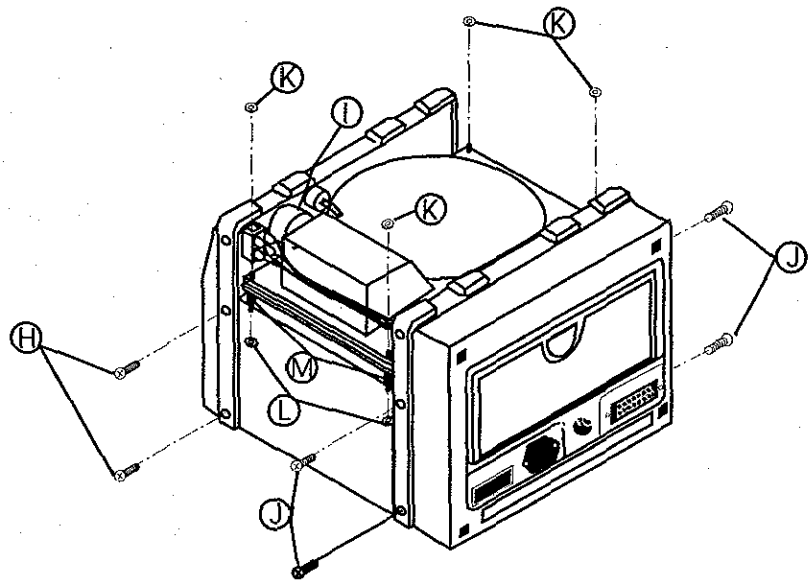


Figure 6-22

6.2.12 Flex Connector Replacement

Replacement Kit Number: 332165

Repair Kit Contents	Tools Required
Flex connector (1) Hose clamps (3) Tie wrap, ET-3 (1)	Torque screwdriver set to 4 in-lb Cutting pliers Razor blade knife to remove flex connector with glued connection.

Refer to Figures: 6-23, 6-24

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

NOTE: For units with serial numbers greater than 52000, perform Steps 2 to 4 in Section 6.2.20 before proceeding to Step 2.

Step 2 Remove the six Phillips head screws (A) that hold the front end cap (B) in place.

NOTE: The hose clamps ratchet together. Use a slotted screwdriver to open the clamp as shown in Section 6.1.3.

Step 3 Remove and discard the hose clamp from the blower side of the flex connector (C).

Step 4 Remove the remaining Phillips head screw (D) that retains the switch-side crossbar (E) and remove the crossbar (or side panel for units with serial numbers greater than 52000).

Step 5 Turn the unit upside down.

NOTE: For units with serial numbers greater than 52000, perform Steps 2 to 4 of Section 6.2.22 before proceeding to Step 6.

Step 6 Remove and discard the clamp on the blower inlet port (F); slide the bellows off the blower inlet port.

Step 7 Move the front end cap away from the unit.

Step 8 **For glued flex connectors:** Using a razor blade knife, lightly score the flex connector end that is glued to the air outlet port on the front end cap. Cut through the "doughnut" portion of the flex connector, splitting the flex in half.

For clamped flex connectors: Remove and discard the hose clamp from the front end cap side of the flex connector.

Step 9 Peel the flex connector off of the air outlet. Be sure not to leave any excess flex on the outlet.

Step 10 Clean any flex connector or glue remnants from the blower outlet surface.

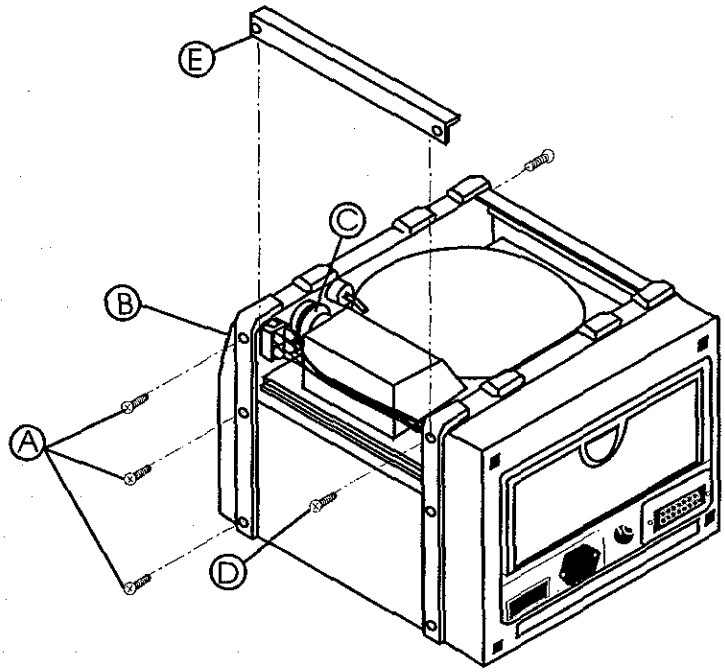


Figure 6-23

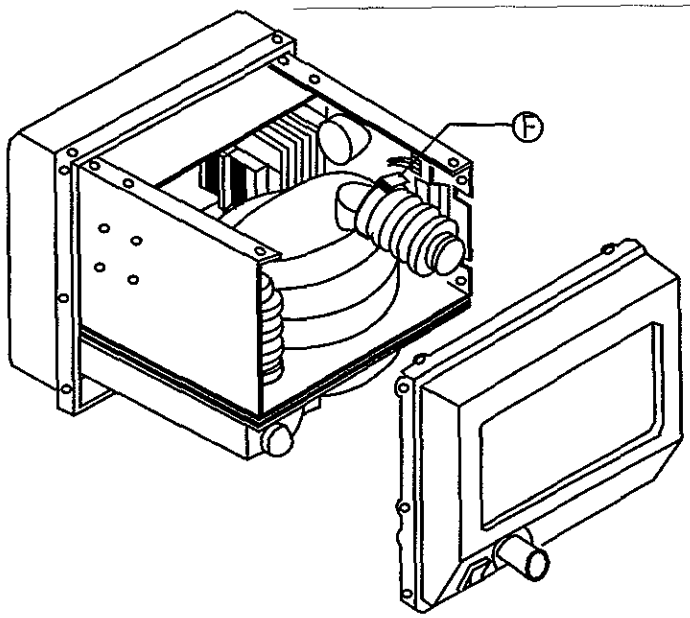


Figure 6-24

Reassembly:

Step 1 Place a new hose clamp over the flex connector on the side to be placed over the outlet port. Apply a fine mist of alcohol on the front cap outlet port, then slide the new flex connector onto the outlet. Tighten the hose clamp over the connector and port.

Step 2 Place the front end cap near the front of the unit. Place a new hose clamp over the inlet bellows and tighten it by one or two ratchets. Apply a fine mist of alcohol on the blower inlet port and slide the inlet bellows over the port. Tighten the hose clamp over the bellows and the inlet port.

NOTE: For units with serial numbers greater than 52000, perform Reassembly Steps 1 to 3 of Section 6.2.22 before proceeding to Step 3.

Step 3 Turn the unit right side up.

Step 4 Place a new hose clamp over the blower end of the flexible connector and tighten it by one or two ratchets. Apply a fine mist of alcohol on the blower outlet port and slide the flexible connector onto the port. Tighten the hose clamp around the connector and blower outlet port.

Step 5 Attach the front end cap to the unit, but leave out the top screw for the crossbar, if applicable. Use the power screw driver set to 4 in-lb.

NOTE: For units with serial numbers greater than 52000, perform Reassembly Steps 1 to 5 of Section 6.2.21 in place of Step 6.

Step 6 Replace the switch-side crossbar.

Step 7 Replace the wraparound and feet.

Step 8 Perform the System Adjustment and Final Test procedures in Chapter 7 of this manual.

6.2.13 AC Inlet Connector w/Fuse Drawer Replacement

Replacement Kit Number: 332214 for serial numbers less than 150,000
332556 for serial numbers 150,000 or greater

Repair Kit Contents	Tools Required
AC inlet with fuse drawer (1) 4-40 x ⅜" machine screws (2) Wire tie, ET-3 (1) 6 x ⅜" thread cutting screws (2) 4-40 locking nuts (2)	Torque screwdriver capable of 4 and 6 in-lb Needle nose pliers Cutting pliers

Refer to Figures: 6-25, 6-26

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

Step 2 Remove the six Phillips head screws (A) that fasten the rear end cap (B) to the unit.

Step 3 Turn the unit upside down.

Step 4 Pull back the rubber boot (C) that covers the AC inlet wire connections (D).

CAUTION: Before you remove the wire connectors on the AC inlet, label the connectors for proper reconnection.

Step 5 Remove the wire connectors on the AC inlet (E).

Step 6 On the back panel remove the two Phillips head screws (F) that attach the AC inlet connector to the rear end cap. Remove the AC inlet connector/fuse drawer assembly (G).

NOTE: On older units, the AC inlet connector is attached with two Phillips head machine screws with locking nuts on the inside. Use an 11/32" nutdriver to hold the nuts while removing the machine screws.

Step 7 Remove the fuses from the fuse drawer (H) and insert them into the new fuse drawer. See section 4.2.7.

Reassembly:

Step 1 Insert the AC inlet connector/fuse drawer assembly into the rear end cap. Be sure that the fuse drawer is oriented on the lower side of the assembly. Insert and tighten the two 6 x ⅜" Phillips head screws that attach the AC inlet to the rear end cap. Use the torque screwdriver set to 6 in-lb.

NOTE: For older units, insert the two 4-40 x ⅜" Phillips machine screws through the rear end cap and place 4-40 locking nuts on the inside.

Step 2 Reconnect the wire connections to the AC inlet and slide the rubber boot over the connections.

Step 3 Turn the unit right side up.

Step 4 Align the rear end cap mounting holes with the chassis holes; insert and tighten the six Phillips head screws that attach the rear end cap to the unit. Use the torque screwdriver set to 4 in-lb.

Step 5 Replace the wraparound and feet.

Step 8 Perform the System Adjustment and Final Test procedures in Chapter 7 of this manual.

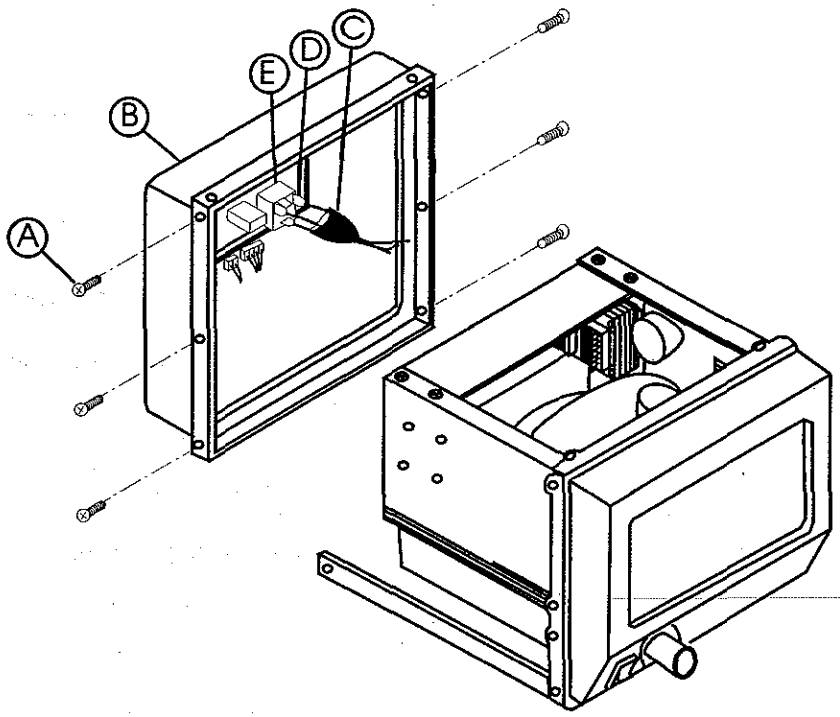


Figure 6-25

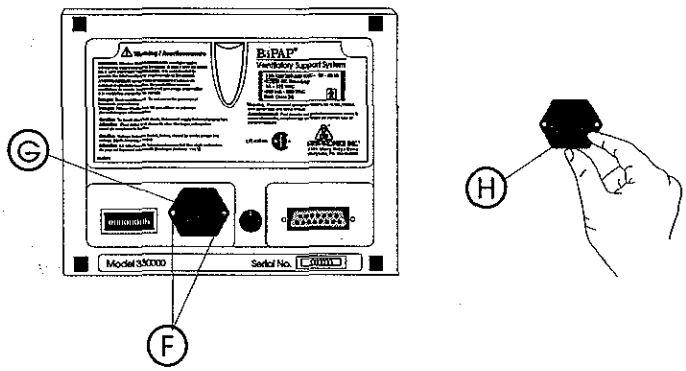


Figure 6-26

6.2.14 Control Knob Replacement

Replacement Kit Number: 332177 D SHAFT (Pull-off knobs)

Repair Kit Contents	Tools Required
Control knobs (5)	None

Refer to Figures: 6-27

Disassembly:

Step 1 Open the cover door on the back panel.

Step 2 Turn all the control knobs (A) to their extreme clockwise positions.

CAUTION: When pulling the control knobs off the shafts, use a straight, firm pull to prevent damage to the potentiometer shafts. If a shaft is damaged, you must replace the BiPAP Control Board (BCB).

Step 3 Remove the knobs by pulling them straight off the shafts.

NOTE: If the knobs don't come off of the shafts, they are the style knobs that were previously used and have set screws (B) that must be removed before removing the knobs. These knobs can be replaced by knobs without screws.

CAUTION: Before replacing the control knobs, visually check the shafts for cracks; if cracks are discovered, you must replace the BCB.

Reassembly:

Step 1 Verify that the shafts are turned to their extreme clockwise positions; replace the control knobs by aligning the indicator line on the knob with the highest setting on the panel label.

Step 2 Push the new control knobs onto the shafts.

Step 3 Perform the System Adjustment and Final Test procedures in Chapter 7 of this manual.

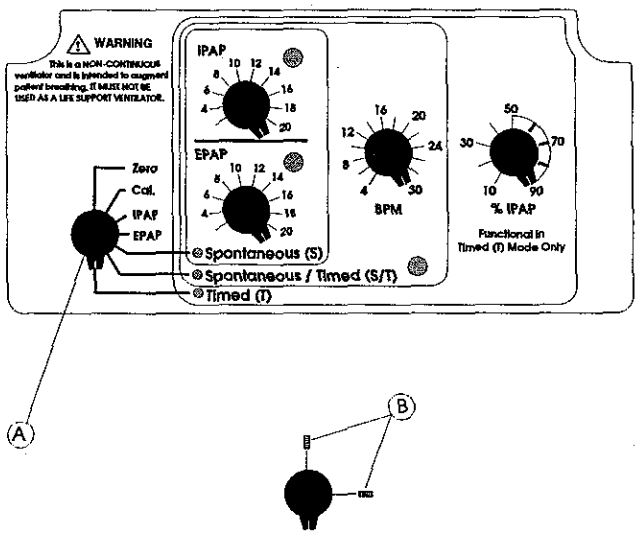


Figure 6-27

6.2.15 Voltage Selector Switch Replacement

Replacement Kit Number: 332175 for serial numbers less than 200,000
332555 for serial numbers 200,000 or greater

Repair Kit Contents	Tools Required
Voltage selector switch (1) Tie wraps, ET-3 (3)	Torque screwdriver set to 4 in-lb Needle nose pliers

Refer to Figures: 6-28

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

Step 2 Remove the six Phillips head screws (A) holding the rear end cap (B) in place.

Step 3 Turn the unit upside down.

Step 4 Tilt the rear end cap away from the unit frame.

CAUTION: Before removing the voltage selector switch wires from the transformer, note the proper position of the wires and label them for reconnection.

Step 5 Remove the voltage selector switch wires (C) from transformer terminals 1, 2, 5, and 6 (D). Cut the nylon wire tie that holds each pair of wires.

Step 6 With a pair of needle nose pliers, remove the nylon nut (E) that secures the voltage selector switch (F) to the rear end cap.

Step 7 When the nut is removed, feed the wires, one at a time, through the nut.

Step 8 Remove the voltage selector switch.

Reassembly:

Step 1 Place the new voltage selector switch in the rear end cap and feed its wires through the nylon nut, one at a time.

Step 2 With a pair of needle nose pliers, tighten the nylon nut against the rear end cap. DO NOT OVER-TIGHTEN. Be sure that the tab on the voltage selector switch aligns with the notch in the selector hole in the chassis.

Step 3 Reconnect the voltage selector switch wires to transformer terminals 1, 2, 5, and 6. Group the red and white wire together and secure them together with a nylon wire tie near the transformer. Repeat for the black and yellow wire.

Step 4 Replace the rear end cap and tighten with six Phillips head screws. Use the torque screwdriver set to 4 in-lb.

Step 5 Turn the unit right side up.

Step 6 Perform the System Adjustment and Final Test procedures in Chapter 7 of this manual.

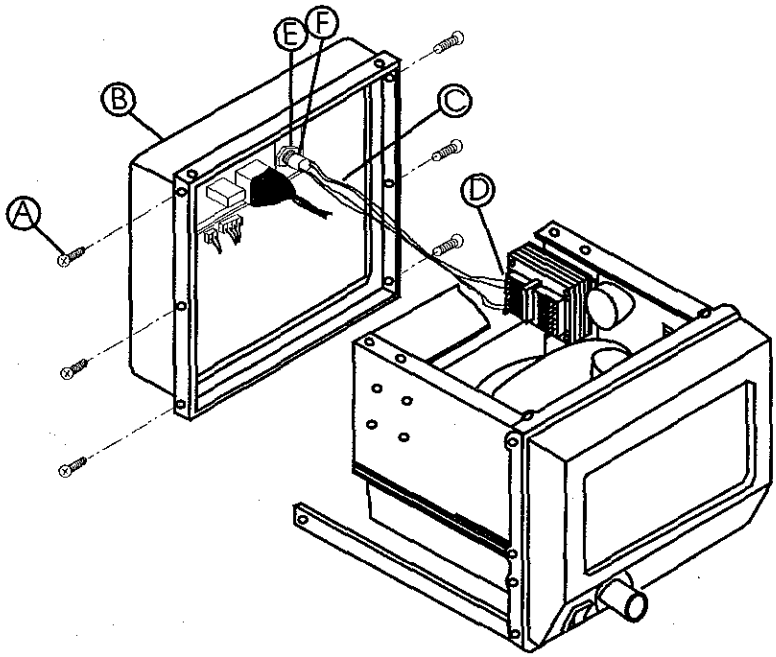


Figure 6-28

6.2.16 Time Meter Replacement

Replacement Kit Number: 332176

Repair Kit Contents	Tools Required
Time meter (1) Tie wrap, ET-3 (1) Time meter labels (2)	Torque screwdriver set to 4 in-lb Hot glue gun Razor blade knife Denatured alcohol

Refer to Figures: 6-29

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

Step 2 Remove the six Phillips head screws (A) holding the rear end cap (B) in place.

Step 3 Turn the unit upside down.

Step 4 Tilt the rear end cap away from the unit frame.

CAUTION: Before removing the time meter wire plug from the Motor Controller Board, note the proper position and orientation of the plug.

Step 5 Remove the time meter wires (C) from the Motor Controller Board. The time meter wires are the last set to the right of the connector (purple and green wires).

Step 6 With a slotted screwdriver, release the wire retaining clip (D) on the bottom of the blower assembly and remove the wires.

Step 7 Apply some alcohol to the hot melt glue that secures the time meter (E) to the rear end cap. You may have to lightly score the glue as well. Peel the glue away from the rear end cap and the time meter.

Step 8 Push the time meter out of the rear end cap and remove any excess glue from the rear end cap.

Reassembly:

Step 1 Place the new time meter in the rear end cap.

Step 2 Apply hot melt glue around the outside of the time meter, securing the meter to the rear end cap.

Step 3 Reconnect the time meter wires to the Motor Controller board. Secure the time meter wires with nylon tie wraps at 2 places along the length of the wires.

Step 4 Replace the rear end cap and tighten the six Phillips head screws. Use the torque screwdriver set to 4 in-lb.

Step 5 Turn the unit right side up.

Step 6 Take out the two labels that are supplied in the replacement kit. Write the hours of the old meter and the date it was replaced on both labels. Apply one label on the paperwork. To apply the second label to the BiPAP unit, turn the unit so that the rear end cap is facing up. Place the label on the bottom of the rear end cap, adjacent to the Model Number.

Step 7 Replace the wraparound and feet.

Step 8 Perform the System Adjustment and Final Test procedures in Chapter 7 of this manual.

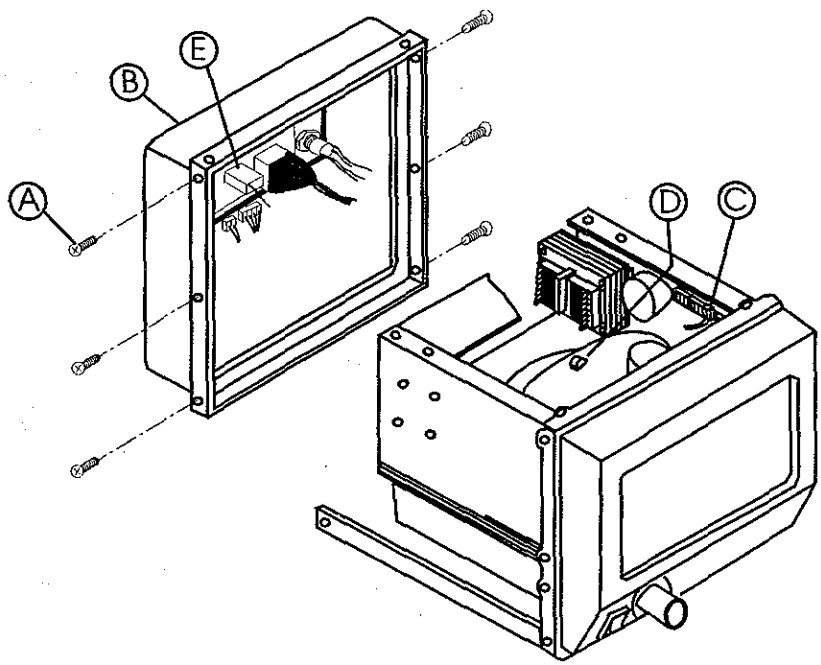


Figure 6-29

6.2.17 Pressure Port Replacement (S-D and S/T-D Models Only)

Replacement Kit Number: 332162

Repair Kit Contents	Tools Required
Pressure port (1) Tie wrap, ET-3 (1) Pressure port label (1) Hose clamps (2)	Torque screwdriver set to 4 in-lb Cutting pliers Medium slotted screwdriver $^{13}/_{16}$" socket

Refer to Figures: 6-30

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

Step 2 Remove the six Phillips head screws (A) that hold the front end cap (B) in place.

NOTE: For units with serial numbers greater than 52000, perform Steps 2 to 4 of Section 6.2.20 before proceeding to Step 3.

NOTE: The hose clamps ratchet together. Use a slotted screwdriver to open the clamp.

Step 3 Remove and discard the hose clamp (C) from the flex connector.

Step 4 Cut the nylon tie wrap that holds the pressure port tube (D) on the pressure port. Pull the tube off of the pressure port.

Step 5 Tilt the front end cap away from the unit.

Step 6 Remove the pressure port retaining ring from the inside of the front end cap. Use wire cutters to cut the ring.

Step 7 Remove the pressure port from the front end cap.

Reassembly:

Step 1 Apply the "PRESSURE" label to the new pressure port as follows:

a. Hold the port with the flat portion on top.
b. Peel the backing off the label and place it on the front bottom center of the port.

Step 2 Slide the port into the front end cap. The hole is flattened on top to match the flat portion of the port.

Step 3 Place the retaining ring onto the inside of the pressure port. Place a $^{13}/_{16}$" socket over the retaining ring, put pressure on the front of the front end cap and push the retaining ring until it is against the inside of the front end cap.

Step 4 Place a new hose clamp over the flexible connector and tighten it by one or two ratchets. Apply a fine mist of alcohol on the blower outlet port and slide the flexible connector onto the port. Tighten the hose clamp around the connector and blower outlet port.

Step 5 Push the pressure port tube onto the pressure port and tighten with a nylon tie wrap.

NOTE: For units with serial numbers greater than 52000, perform Reassembly Steps 1 to 3 of Section 6.2.20 before proceeding to Step 6.

Step 6 Attach the front end cap to the unit with six Phillips head screws. Use the torque screwdriver set to 4 in-lb.

Step 7 Replace the wraparound and feet.

Step 8 Perform the System Adjustment and Final Test procedures in Chapter 7 of this manual.

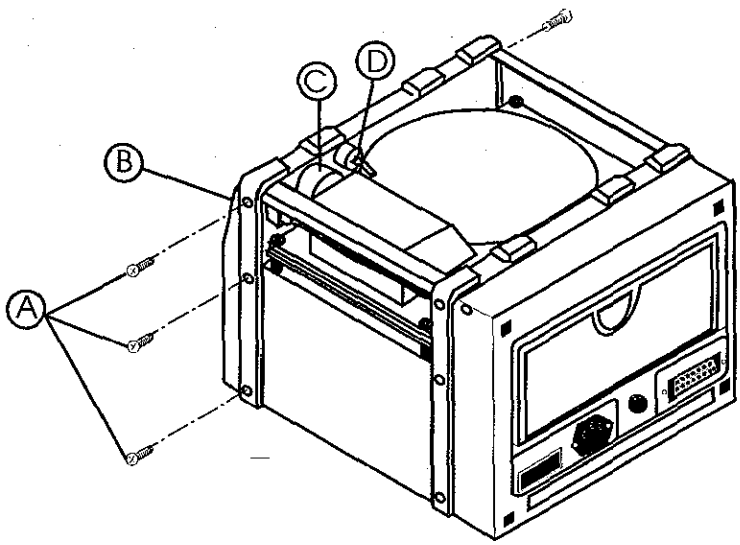


Figure 6-30

6.2.18 Crowbar Fuse Replacement

Replacement Kit Number: 332302

Repair Kit Contents	Tools Required
500 mA time delay fuses (2)	Needle nose pliers Cutting pliers Torque screw driver capable of 4 in-lb and 6 in-lb Torque nut driver capable of 4 and 6 in-lb Manual screwdriver set to 6 in-lb .050" Allen wrench (for models with set-screw control knobs)

Refer to Figures: 6-31

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

Step 2 Remove the BiPAP Control Bard (BCB) as described in Section 6.2.4.

Step 3 Turn the BCB with the component side toward you. Carefully remove the fuse (A) from its holder.

Reassembly:

Step 1 Insert a new time delay fuse into the fuse holder.

Step 2 Replace the BCB as described in Section 6.2.4.

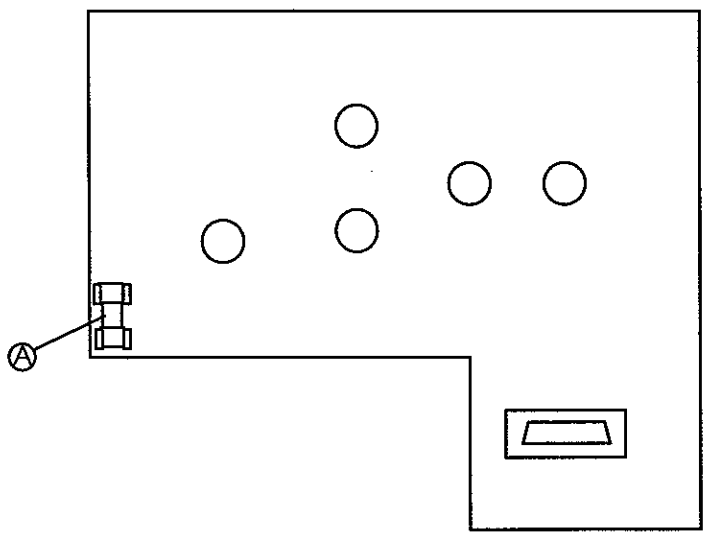


Figure 6-31

6.2.19 Latch Replacement

Replacement Kit Number: 332221

Repair Kit Contents	Tools Required
BiPAP latches (2) BiPAP latch keeper (2) 4-40 x 3/8" Phillips screws (4) 4-40 x 5/16" Phillips screws (4) 4-40 Locking nuts (4)	Power screw driver set to 4 in-lb

Refer to Figures: 6-32

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

Step 2 Remove the four 5/16" Phillips screws (A) from the latches (B) on the accessory cap (C).

Step 3 Remove the four 3/8" Phillips screws (D) from the latch keepers (E) on either side of the wraparound (F).

Reassembly:

Step 1 Align the holes of the new latch keeper with the holes on the wraparound. Secure the latch keeper with two 3/8" Phillips screws. Use the torque screwdriver set to 4 in-lb.

Step 2 Align the holes of the new latch with the holes on the accessory cap. Secure the latch with two 5/16" Phillips screws and two locking nuts (on the inside of the accessory cap). Use the torque screw

Step 3 Replace the wraparound and feet.

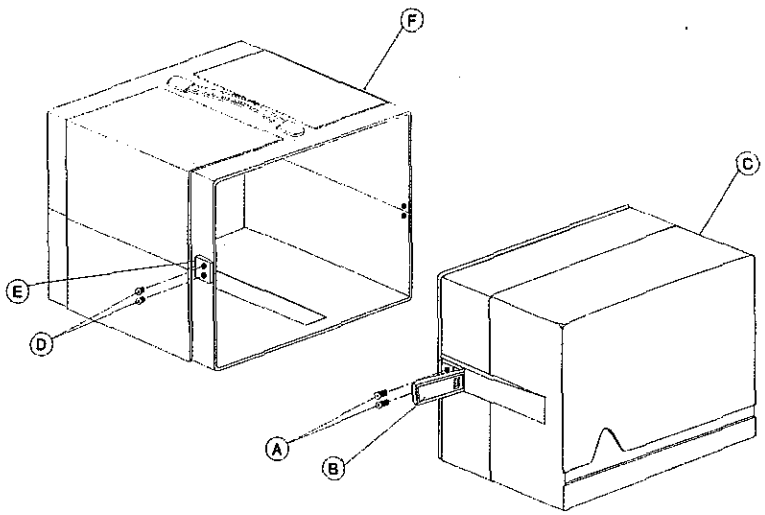


Figure 6-32

6.2.20 Top Plate Replacement

Replacement Kit Number: 332440

NOTE: This kit cannot be installed in BiPAP units with serial numbers less than 52000.

Repair Kit Contents	Tools Required
BiPAP top plate (1)	Torque screwdriver set to 4 in-lb

Refer to Figures: 6-33, 6-34

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

Step 2 Remove the four Phillips head screws (A) that secure the top plate (B) to the side plates (C).

Step 3 Lift the top plate off the BiPAP unit. Pull the front and back edges of the top plate from under the edges of the front and rear end caps.

Step 4 Note the position of the foam (D) that is attached to the inside of the top plate. The plate must be positioned in the same way when you reassemble the BiPAP unit.

Reassembly:

Step 1 Position the top plate on the top of the BiPAP unit. Ensure that the foam on the plate is inserted over the blower side of the unit.

Step 2 Align the four holes in the top plate with the four holes in the tops of the side panels.

Step 3 Insert and tighten the four Phillips screws that secure the top plate to the side panels. Use the torque screwdriver set to 4 in-lb.

Step 4 Replace the wraparound and feet.

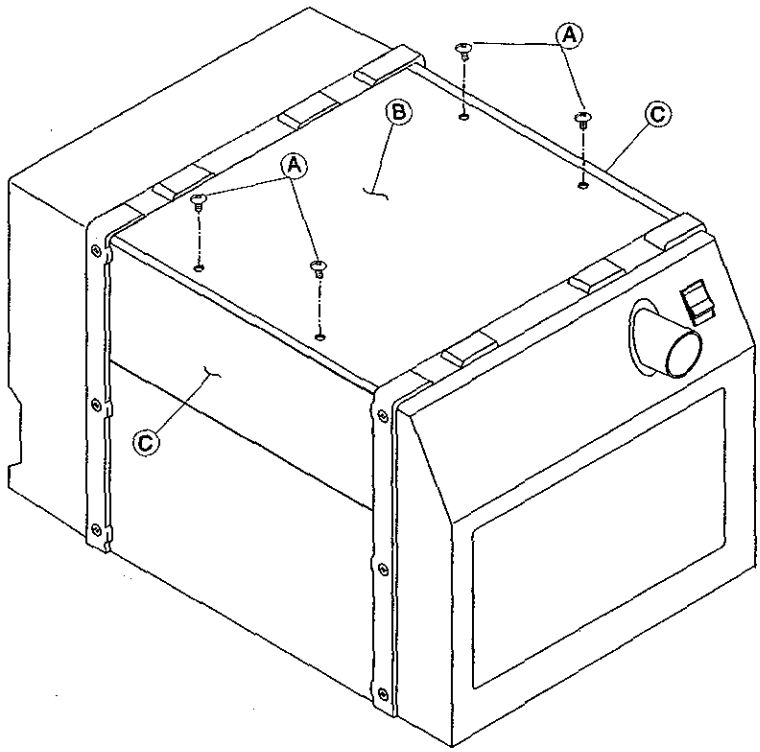


Figure 6-33

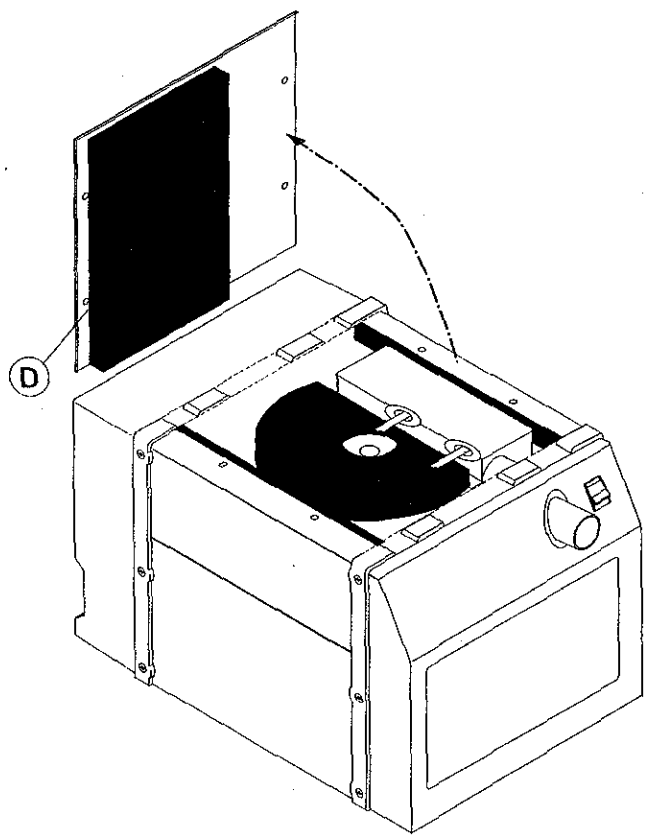


Figure 6-34

6.2.21 Side Panel Replacement

Replacement Kit Number: 332443

Repair Kit Contents	Tools Required
BiPAP side panel (2)	Torque screwdriver set to 4 in-lb

Refer to Figure: 6-35

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

Step 2 Remove the top plate as described in Section 6.2.20.

Step 3 Remove the six Phillips head screws (A) that secure the front end cap (B) to the frame. You will have to move the front end cap slightly away from the frame to facilitate the removal of the side plates.

Step 4 Remove the two Phillips head screws (C) that secure the rear end cap to side panels.

Step 5 Slide the Side Panels (D) and (E) out from the unit. Be sure to note from which side the panels are removed; they are not interchangeable.

Reassembly:

Step 1 Place the side panels into their original positions and align the holes through the front and rear end caps.

Step 2 Insert and slightly tighten the two rear end cap screws and the six front end cap screws.

Step 3 When all the side panel and end cap screws are inserted, tighten all the screws with the torque screwdriver set to 4 in-lb.

Step 4 Return the top plate to its original position and align the holes in the plate with the holes in the side panels.

Step 5 Insert and tighten the four screws that secure the top panel to the side plates. Use the torque screwdriver set to 4 in-lb.

Step 6 Replace the wraparound and feet.

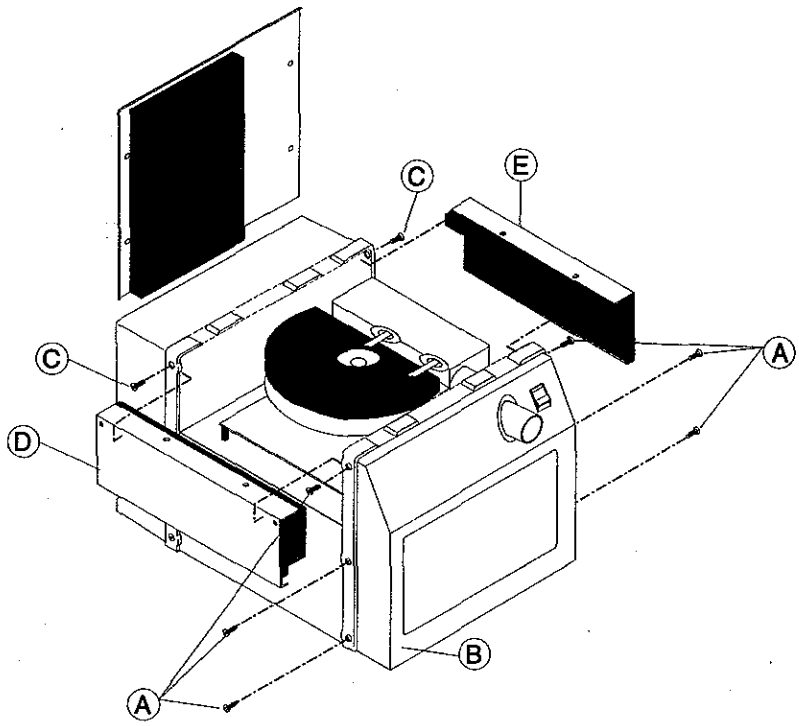


Figure 6-35

6.2.22 Bottom Plate Replacement

NOTE: This kit cannot be installed in BiPAP units with serial numbers less than 52000.

Replacement Kit Number: 332445

Repair Kit Contents	Tools Required
BiPAP bottom plate (1)	Torque screwdriver set to 4 in-lb

Refer to Figures: 6-36, 6-37

Disassembly:

Step 1 Remove the wraparound as described in Section 6.1.1, Preparing the Unit for Service.

Step 2 Turn the BiPAP unit over so that it is resting on its top.

Step 3 Remove the six Phillips head screws (A) that secure the bottom plate (B) to the frame.

Step 4 Remove the bottom plate, noting the orientation of the plate.

Reassembly:

Step 1 Place the bottom plate on the frame. Be sure that the plate is oriented so that the hole in the foam (C) is over the BiPAP valve.

Step 2 Align the six holes in the bottom plate with the six holes in the frame.

Step 3 Insert and tighten the six Phillips screws that secure the bottom plate to the frame. Use the torque screwdriver set to 4 in-lb.

Step 4 Replace the wraparound and feet.

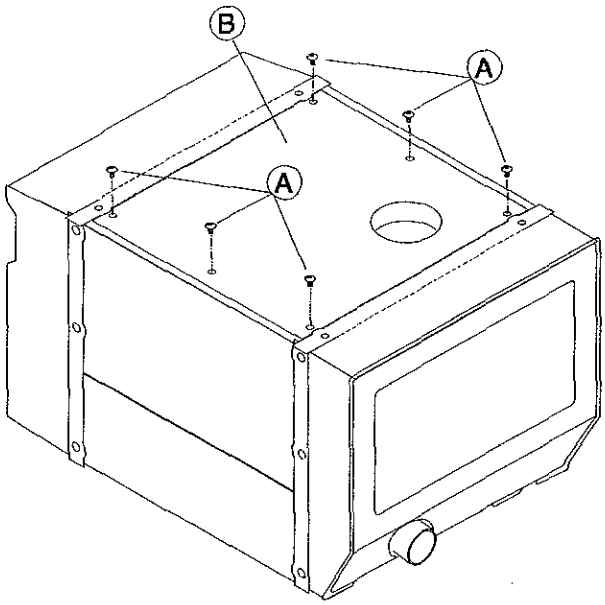


Figure 6-36

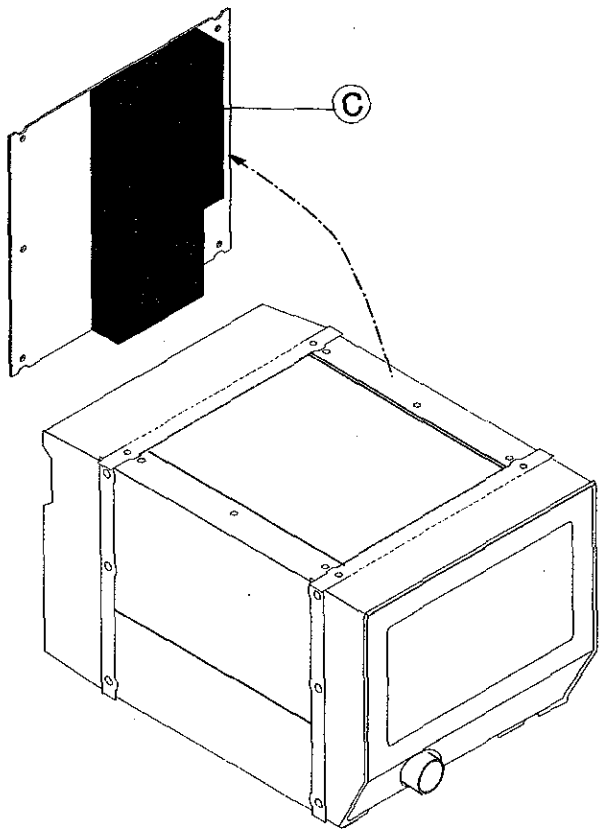


Figure 6-37

Chapter 7 System Adjustment and Final Tests

7.1 Requirements

7.2 Initial Equipment Set-up

7.3 Selector Switch Movement Test

7.4 Blower Pressure Adjustment

7.5 Flow Transducer Calibration

7.6 Valve Control Calibration

7.7 Pressure Monitor Calibration

7.8 Pressure Monitor Calibration Using DCP

7.9 Blocked and Unblocked Watts

7.10 Trigger Level Verification

7.11 Overnight Run/Morning Check

7.12 System Final Test

7.13 Spontaneous Mode Verification

7.14 Spontaneous/Timed Mode Verification

7.15 Timed Mode Verification

7.16 Verify Zero Function

7.17 Verify Calibrate Function

7.18 DCP Verification

7.19 Corrective Actions

CAUTION: Electronic components used in this unit are subject to damage by static electricity. Use proper static discharge and grounding precautions when servicing the equipment. Service only at a static-free workstation.

NOTE: The procedures in this chapter are used for both the adjustment and final test. The only difference is that during adjustment the trimpots are adjusted to specifications and measurements are recorded. During the final test, trimpots are not adjusted and measurements are verified to specifications and recorded.

7.1 Requirements

7.1.1 Equipment

Major Items:

- Oscilloscope
- Multimeters
- Electronic Manometer
- Watt Meter (150W full scale, 1W resolution) with unit power cord
- Flow Meter System
- DCP (S-D and S/T-D units only)
- Trigger Level Test Fixture — Respironics #332300
- BiPAP Small Tool Kit — Respironics #332301
- Air pressure source capable of delivering 50 psi.
- Manometer tubing with smooth inner lumen

See Appendix A for a complete list and a list of acceptable alternate equipment.

7.1.2 Data Sheet

You must complete a System Data Sheet for each test you perform. Appendix B contains the sheet, which you may copy for each test you perform. The sheet is two-sided; one side of the System Data Sheet may be used for the adjustment, and the other side for the final test.

7.1.3 Required Tests

The chart below indicates which procedures you must use for the BiPAP model you are testing. A "Y" in the column means you must perform the test; an "N" indicates the test is not applicable to the model.

	Model			
Procedure	S	S/T	S-D	S/T-D
7.3	Y	Y	Y	Y
7.4	Y	Y	Y	Y
7.5	Y	Y	Y	Y
7.6	N	N	Y	Y
7.7	N	N	Y	Y
7.8	Y	Y	Y	Y
7.9	Y	Y	Y	Y
7.10	Y	Y	Y	Y
7.11	Y	Y	Y	Y
7.12	Y	Y	Y	Y
7.13	N	Y	N	Y
7.14	N	Y	N	Y
7.15	N	N	Y	Y
7.16	N	N	Y	Y
7.17	N	N	Y	Y
7.18	Y	Y	Y	Y

7.1.4 Test Sequence

The required tests are performed twice. The first time, called the adjustment, is used to make adjustments to the unit. The second run is called the final; you simply record the measurements. The system adjustment and final are to be performed as followed:

1. Perform the system adjustments.
2. Run the unit for a minimum of 1 hour (8 hours overnight suggested).
3. Check the outlet temperature.
4. Perform the final tests.

7.2 Initial Equipment Set-up

Figure 7-1 shows the initial equipment set-up.

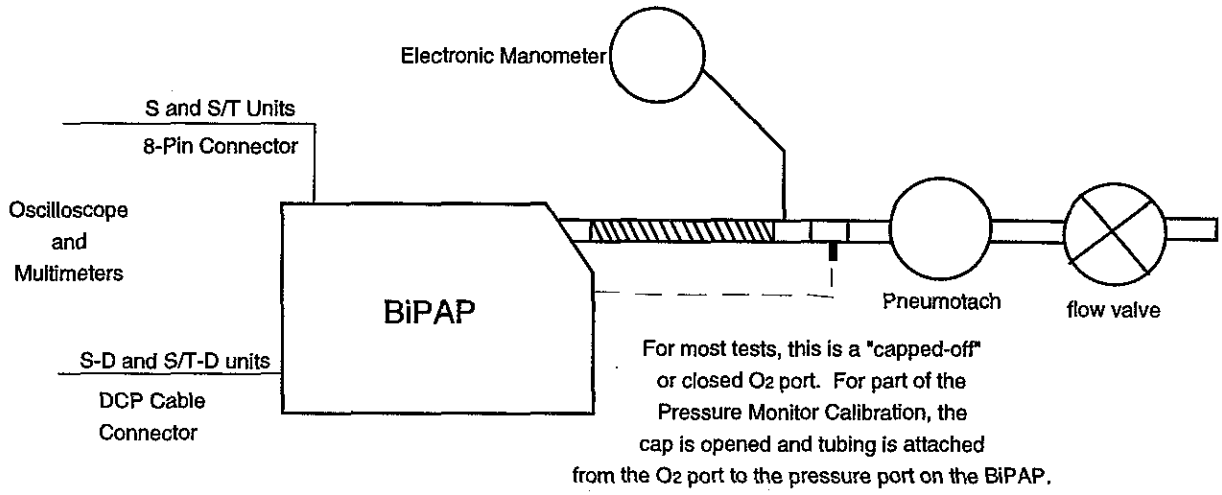
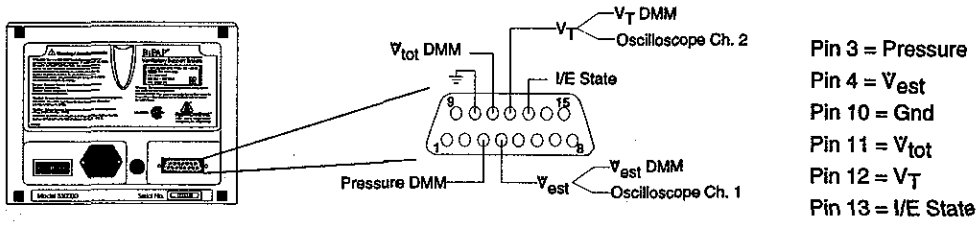


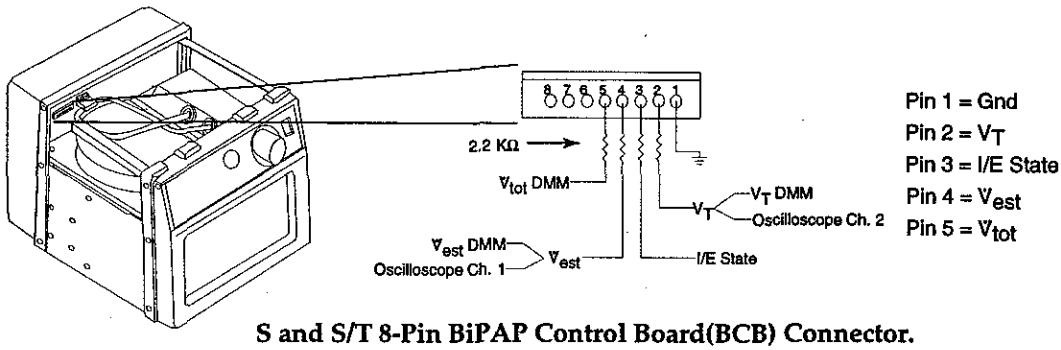
Figure 7-1. Initial Equipment Set-up.

1. Plug the BiPAP unit to be tested into the watt meter. Plug the watt meter into a power source.
2. Attach one end of the 6 ft. tubing, with a smooth inner lumen, to the outlet of the BiPAP unit.
3. Insert two O_2 ports into the other end of a 6 ft.tube.
4. Attach a length of tubing from the first O_2 port to a calibrated or electronic manometer.
5. "Cap-Off" the second O_2 port.
6. Attach the "Up-Stream" end of a pneumotach (i.e. flow tube part of a flowmeter) to the second O_2 port.
7. Attach a flow valve to the "down-stream" end of the pneumotach.

You will access six electrical signals (five for S and S/T units) from the BiPAP unit. These signals may be obtained from the DCP cable connector for the S-D and S/T-D units, or from the 8-pin connector on the BiPAP Control Board (BCB) on S and S/T units. Figure 7-2 shows the pin assignments for the DCP cable connector and the 8-pin connector.



S-D and S/T-D DCP Connector on BiPAP Unit.
(Viewed from rear of unit)



S and S/T 8-Pin BiPAP Control Board(BCB) Connector.
Note: You must remove the cover to access the connector.

It is suggested that you add a 2.2kΩ resistor in series with each output except the ground.(this reduces the 'noise' on the signals).
Note: You must remove the cover to access the connector.

Figure 7-2. Pin Assignments.

The system is ready to be tested. Follow any additional set-up procedures for each test function as required.

NOTE: If at any time during the following tests the unit fails to meet the specifications as stated, repeat the test for the appropriate specification. If the unit fails a second time, mark in the comment area what the problem is, record the hour meter reading, sign and date the history papers, and prepare the unit for repair. See Section 7.18 for corrective actions to take for a failure in any test.

CAUTION: Wear a grounding wrist strap to prevent static electric damage any time a unit is being handled or tested.

7.3 Blower Pressure Adjustment (all units)

7.3.1 Test Equipment Set-up

The test equipment remains the same from the Initial Set-up, Section 7.2.

7.3.2 BiPAP Set-up

Step 1 Close the flow valve.

Step 2 Set the BiPAP selector switch to IPAP mode.

Step 3 Set the IPAP control knob to maximum (full clockwise).

Figure 7-3 shows the location of the trimpot R6 on the motor control board.

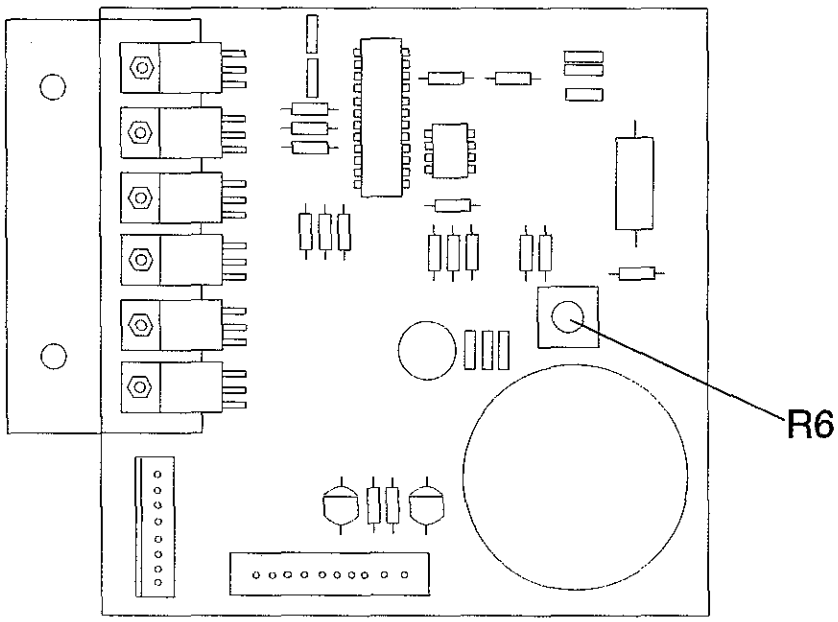


Figure 7-3

7.3.3 Test Procedure

Step 1 Hold the BiPAP valve completely shut.

Step 2 Adjust the flow valve for 100 L/min flow (±2 L/min).

Step 3 Adjust R6 on the motor control board to obtain 20 cm H_20 on the manometer.

Step 4 Re-adjust the flow valve if necessary to maintain 100 L/min flow.

Step 5 Re-adjust R6 for 20 cm H_20 (±1 cm). Record the blower presure.

Step 6 Momentarily block the flow valve and hold the BiPAP valve shut to attain zero flow (±1 L/min).

Step 7 Measure and record the dead-head pressure.

Step 8 Unblock the flow valve and verify 20 cm H_20 (±1 cm) pressure at 100 L/min flow.

Step 9 Stop holding the BiPAP valve shut.

7.4 Flow Transducer Calibration (all units)

NOTE: As of February, 1992, Respironics began using a new flow transducer/BiPAP Control Board (BCB) combination. Since the flow transducer calibration differs between the transducers, two calibration sections (7.5.3 and 7.5.4) are now presented. You must identify the part number of the transducer in the unit you are calibrating, and select the appropriate procedure. The Test Equipment and BiPAP set-ups are identical. The old transducer number is 332046. The board used with this transducer includes trimpot R91. The new transducer number is 332290. The board used with the new transducer does not have trimpot R91. You can find the transducer number on the Blower S/A label located on top of the flow transducer. (If there is no tranducer number, then the flow transducer is the new number 332290.)

If a new blower has ben installed in a unit with an old BCB which has R91 then, you may not be able to perform the flow calibration; the board, in about 10% of the cases, does not have enough gain. If this occurs, Respironics recommends that you install a new board to ensure the successful calibration of the transducer, but you may try another old board.

7.4.1 Test Equipment Set-up

The test equipment remains the same from the Initial Set-up, Section 7.2.

7.4.2 BiPAP Set-up

Step 1 Close the flow valve.

Step 2 Set the BiPAP selector switch to IPAP mode.

Step 3 Set the IPAP control knob to maximum (full clockwise).

Step 4 Access the $\dot{V}_{tot}$ (total flow) signal with a multimeter. (Example: read millivolts DC mV range 2000 on Amprobe.)

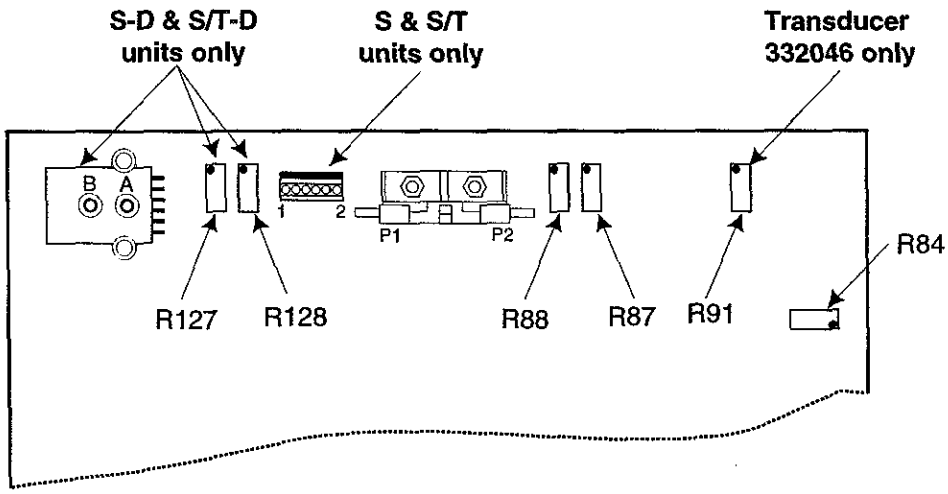


Figure 7-4 shows the location of the trimpots on the BCB.

Figure 7-4

7.4.3 Test Procedure for Transducer 332046 (Trimpot R91)

Adjust Flow Transducer:

Step 1 Adjust R88 for 0 VDC on the $\dot{V}_{tot}$ meter (± 5 mV). Remove the adjustment tool from the trimpot and allow the setting to stabilize before continuing.

Step 2 Adjust the flow valve for 60 L/min (±1) on the pneumotach.

Step 3 Measure the $\dot{V}_{tot}$ signal in a to DCV range such as 20

Step 4 Adjust R91 to obtain the maximum voltage output on the $\dot{V}_{tot}$ meter (i.e. until the voltage just stops increasing i.e. just 'levels off' i.e. 'just plateau's'). The maximum voltage can be from 1.2 V to 2.5 V, and typically is 1.4 V to 1.6 V.

Step 5 Adjust R87 for 1.50 V (± 30 mV) output of the $\dot{V}_{tot}$ signal.

Step 6 Re-adjust R91 for 1.00 V (± 20 mV) output on the $\dot{V}_{tot}$ meter.

Step 7 Block the outlet and verify that zero flow produces 0 VDC (± 30 mV) of the $\dot{V}_{tot}$ signal. Record the voltage on the System Data Sheet for 0 L/min if it is within specification.

Step 8 If the zero flow voltage is not within specification, repeat Steps 1-7.

Record Flow Transducer:

Step 1 Unblock the outlet and adjust the flow valve for 30, 60, 90, and 120 L/min flow and record the $\dot{V}_{tot}$ reading for each step.

7.4.4 Test Procedure for Transducer 332290 (no Trimpot R91)

Adjust Flow Transducer:

Step 1 Adjust R88 for 0 VDC of the $\dot{V}_{tot}$ signal (± 5 mV). Remove the adjustment tool from the trimpot and allow the setting to stabilize before continuing.

Step 2 Adjust the flow valve for 60 L/min (±1) on the pneumotach.

Step 3 Measure the $\dot{V}_{tot}$ signal in a DCV range , such as 20.

Step 4 Adjust R87 for 1.00 V (± 20 mV) output of the $\dot{V}_{tot}$ signal.

Step 5 Block the outlet and verify that zero flow produces 0 VDC (± 10 mV) of the $\dot{V}_{tot}$ signal. Record the voltage on the System Data Sheet for 0 L/min if it is within specification.

Step 6 If the zero flow voltage is not within specification, repeat Steps 1-5.

Record Flow Transducer:

Step 1 Unblock the outlet and adjust the flow valve for 30, 60, 90, and 120 L/min flow and record the $\dot{V}_{tot}$ reading for each step.

7.5 Valve Control Calibration (all units)

7.5.1 Test Equipment Set-up

The test equipment remains the same from the Initial Set-up, Section 7.2.

7.5.2 BiPAP Set-up

Step 1 Close the flow valve. Set the BiPAP selector switch to IPAP mode.

7.5.3 Test Procedure

Calibrate Valve Control:

Step 1 Turn the IPAP control knob to 20 cm.

Step 2 Adjust R84 for 20.5 cm H_2O (± 0.2 cm) on the manometer.

Step 3 Record the pressure on the manometer for each control knob setting: 20, 18, 12, 6, and minimum (usually about 1.4).

Step 4 Turn the function selector knob to the EPAP mode and repeat Step 3 using the EPAP control knob.

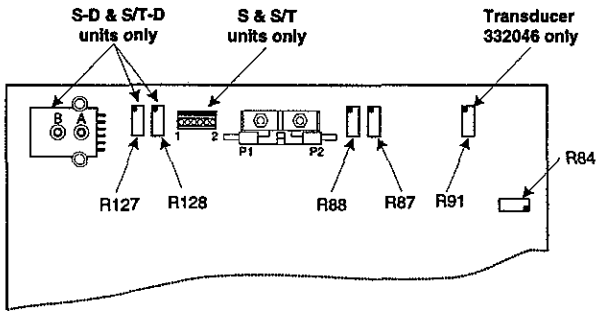


Figure 7-5

Pressure vs. Flow:

Step 1 Verify the flow valve is still closed. The flowmeter should read 0 flow.

Step 2 Turn the function selector knob to the IPAP mode and adjust the IPAP control knob until 18 cm H_2O is obtained on the manometer.

Step 3 Open the flow valve to 50 and100 L/min and record the pressure for each setting.

Step 4 Close the flow valve.

Step 5 Adjust the IPAP control knob until 12 cm H_2O is obtained on the manometer.

Step 6 Open the flow valve for 50 and 100 L/min and record the pressure for each setting.

Step 7 Close the flow valve.

Step 8 Adjust the IPAP control knob until 6 cm H_2O is obtained on the manometer

Step 9 Open the flow valve for 50 and100 L/min and record the pressure for each setting.

NOTE: Some RT-200's may not be able to measure 6cm H_2O at 10L/min., i.e. only 60-70 L/min. can get through.

NOTE: The unit is not required to meet specifications at 150 L/min. The measurement was made for engineering purposes only. Older service manual, and System Test Data Sheets may mention 150L/min flow valve settings.

7.6 Pressure Monitor Calibration (S/T-D and S-D units)

NOTE: Use this procedure when only the BiPAP unit itself is being calibrated.

7.6.1 Test Equipment Set-up

The test equipment remains the same from the Initial Set-up, Section 7.2.

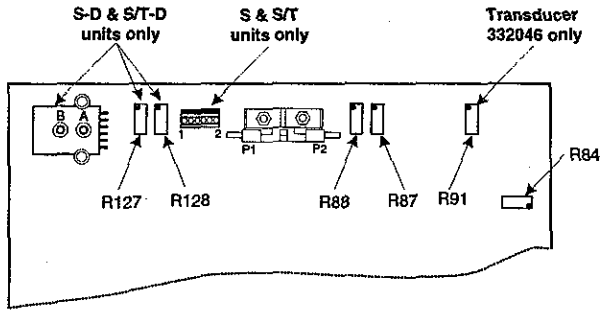


Figure 7-6

7.6.2 BiPAP Set-up

Step 1 Close the flow valve.

Step 2 Set the BiPAP selector switch to IPAP mode.

Step 3 Set the IPAP control knob to maximum (full clockwise).

Figure 7-6 shows the location of the trimpots on the BCB.

7.6.3 Test Procedure

Calibrate Pressure Monitor:

Step 1 Set R127 for 0 VDC (0.0 to 0.1) on the Pressure signal.

Step 2 Uncap the capped O_2 port pressure pick-off and attach manometer tubing from the O_2 port to to the pressure port on the BiPAP.

Step 3 Adjust the IPAP control knob for 10 cm H_2O (± .1 cm) on the manometer.

Step 4 Adjust R128 for 1.0 VDC (± 0.1) on the Pressure signal.

Step 5 Remove the tubing from BiPAP pressure port and record zero 0 VDC (0.0 to0.1). Reattach the tubing.

Step 6 Verify that the Pressure meter reads 1.0 VDC (± 0.1).

Step 7 Set the IPAP control knob for pressures of 5, 10, 15, 20 cm H_2O on the manometer, and record the Pressure signal voltage for each setting.

7.7 Pressure Monitor Calibration (Using the DCP)

NOTE: Use this procedure if both a BiPAP and specific DCP are being calibrated together.

7.7.1 Test Equipment Set-up

The test equipment remains the same from the Initial Set-up, Section 7.2, except for connecting a DCP to the BiPAP.

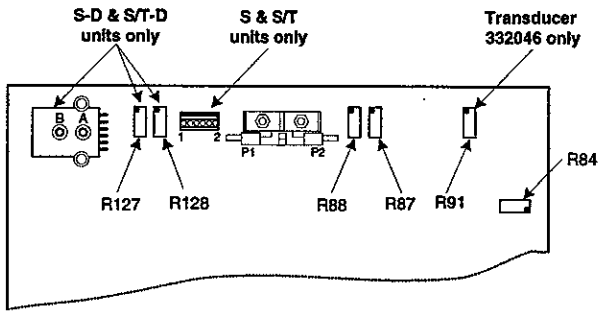


Figure 7-6

7.7.2 BiPAP Set-up

Step 1 Close the flow valve.

Step 2 Set the DCP function selector knob to the IPAP mode.

Step 3 Set the DCP IPAP control knob to minimum (full clockwise).

Step 4 Set the DCP display selector knob to IPAP.

Figure 7-6 shows the location of the trimpots on the BiPAP BCB.

7.7.3 Test Procedure

Calibrate Pressure Monitor:

Step 1 Uncap the capped O_2 port pressure pick-off and attach manometer tubing to the O_2 port and to the pressure port on the BiPAP.

NOTE: Use a "T" to connect a calibrated manometer to the pressure port for reference.

Step 2 Set R127 so that the DCP display matches a calibrated reference manometer reading (typically about 1.5 cm H_2O.)

Step 3 Adjust the DCP IPAP control knob for maximum on the manometer.

Step 4 Adjust R128 on the pressure monitor board so the DCP reading matches a calibrated reference manometer reading.

Step 5 Set the DCP IPAP control knob for 5, 10, 15, and 20 cm H_2O and record the DCP display reading for each setting pressure setting.

This procedure is accurate to within 1.2 cm H_2O.

7.8 Blocked and Unblocked Watts (all units)

7.8.1 Test Equipment Set-up

The test equipment remains the same from the Initial Set-up, Section 7.2.

7.8.2 BiPAP Set-up

Step 1 Close the flow valve.

Step 2 Set the BiPAP selector switch to IPAP mode.

Step 3 Set the IPAP control knob to maximum (full clockwise).

7.8.3 Test Procedure

Step 1 Record the blocked AC Watts on the System Data Sheet.

Step 2 Remove the tubing from the outlet and record the unblocked AC watts. The unblocked watts must be less than 85 watts.

Step 3 Record the hour meter reading on the System Data Sheet.

7.9 Trigger Level Verification (all units)

7.9.1 Test Equipment Set-up

Step 1 Remove the BiPAP form the equipment set-up in section 7.2. It requires both an electrical power supply and an air pressure source greater than 50 psi.

Step 2 Set up the Trigger Test Fixture. Connect the output hose of the fixture to the pressure pickoff of the dual O_2 port.

Step 3 Install the dual O_2 port on the outlet of the BiPAP unit. Do not block the second port.

Step 4 Optional: Access the $\dot{V}_{tot}$ and $\dot{V}_{est}$ signals if desired. Use a DCV range of 20.

7.9.2 BiPAP Set-up

Step 1 Set the BiPAP selector switch to SPONTANEOUS mode.

Step 2 Set the IPAP control knob to 12.

Step 3 Set the EPAP control knob to 5.

7.9.3 Test Procedure

Step 1 Turn on the trigger level test fixture. The ball should indicate 3 L/min flow.

Step 2 Block the 0.25" orifice of the test fixture.

Step 3 Wait until the $\dot{V}_{est}$ reading stabilizes (approximately 15 to 30 seconds).

Step 4 Turn off the trigger level test fixture. The unit should trigger 1 to 5 times.

Step 5 Unblock the 0.25" orifice. The unit should trigger 6 to 12 times.

Step 6 Turn on the trigger level fixture. The ball should indicate 3 L/mi flow.

Step 7 Wait until the $\dot{V}_{est}$ reading stabilizes (approximately 15 to 30 seconds).

Step 8 Turn off the trigger level test fixture. The unit should trigger 1 to 5 times.

Step 9 Turn on the trigger level test fixture. The ball should indicate 3 L/min flow.

Step 10 Block the 0.25" orifice of the test fixture.

Step 11 Wait until the $\dot{V}_{est}$ reading stabilizes (approximately 15 to 30 seconds).

Step 12 Turn off the trigger level test fixture. The unit should trigger 1 to 5 times.

7.10 Overnight Run/Morning Check

All units which have been repaired must be run for 1 hour before final testing. If the unit has been repaired due to an issue related to time or temperature then a 8 hour run-in time is required. The following procedure outlines the settings for the run in.

The wraparound should be in place. Install a 0.25 " test adaptor when performing this test.

7.10.1 BiPAP S and S-D Set-up

Step 1 **With test adaptor** — set the mode to Spontaneous, the IPAP control to 8, and the EPAP control to its minimum setting.

7.10.2 BiPAP S/T and S/T-D Set-up

Step 1 **With test adaptor** — set the mode to Spontaneous/Timed, the IPAP control to 8, the EPAP control to 4, the BPM control to 12, and the %IPAP control to 50.

7.10.3 Test Procedure

Step 1 Make sure the wraparound is in place. Plug in the AC cord, turn the unit on, and allow it to run overnight (for a minimum of 8 hours), if the repair was due to a time or temperature issue. Allow the unit to run for a minimum of 1 hour for any other repair. After the unit has run in, check the outlet air temperature and the unblocked watts (set the IPAP control to maximum).

The outlet air temperature should be no more than 25°F above ambient temperature.

The unblocked watts should be less than 85 Watts.

7.11 System Final Test

When the system adjustments and overnight run-in/morning checks are complete, perform the system final test.

NOTE: All equipment remains the same as in section 7.2.

Step 1 Repeat sections 7.3 to 7.10 without making any adjustments. Record the measurements on the data sheet.

Step 2 Remove any tubing or test equipment and install a 0.25" test adaptor.

7.12 Spontaneous Mode Verification (all units)

7.12.1 Test Equipment Set-up

Step 1 Connect Channel 1 of the oscilloscope to the V_T signal (Pin 12 of the DCP cable connector or Pin 2 of the 8-pin connector) and Channel 2 of the scope to the $\dot{V}_{est}$ signal (Pin 4 of the DCP cable connector or Pin 4 of the 8-pin connector).

Step 2 Set up the scope channels as follows:
- Timebase: 1 sec/div
- Sensitivity: Channel 1—500 mV/div
  Channel 2—500 mV/div
- Measure: none

Step 3 Remove the tubing from the outlet and install the 0.25" orifice on the outlet.

7.12.2 BiPAP Set-up

Step 1 Set the BiPAP selector switch to the SPONTANEOUS mode.

Step 2 Set the IPAP control knob to 12.

Step 3 Set the EPAP control knob to 4.

7.12.3 Test Procedure

Step 1 Block and unblock the orifice with a finger and note how the unit switches between EPAP and IPAP.

Step 2 Observe that the EPAP and IPAP LED's illuminate accordingly.

Step 3 Block and hold the orifice closed and observe that the $\dot{V}_{est}$ signal starts to ramp toward 0 V after a short delay, and that the V_T signal also goes to 0 V. Be sure that $\dot{V}_{est}$ is at 0 V before continuing. See Figure 7-7.

Step 4 See Figure 7-8 for oscilloscope traces. Unblock the orifice and watch the V_T signal ramp for approximately 1.0 seconds, then block the orifice.

Step 5 The V_T signal should reset after 1.18 to 1.40 seconds. Shortly after the V_T resets, stop the scope trace near the edge of the screen (press Run/Stop).

Step 6 Measure the time between blocking the orifice ($\dot{V}_{est}$ reset) and V_T reset. Record the measurement on the data sheet.

Step 7 Verify that if EPAP is set higher than IPAP, only IPAP works.

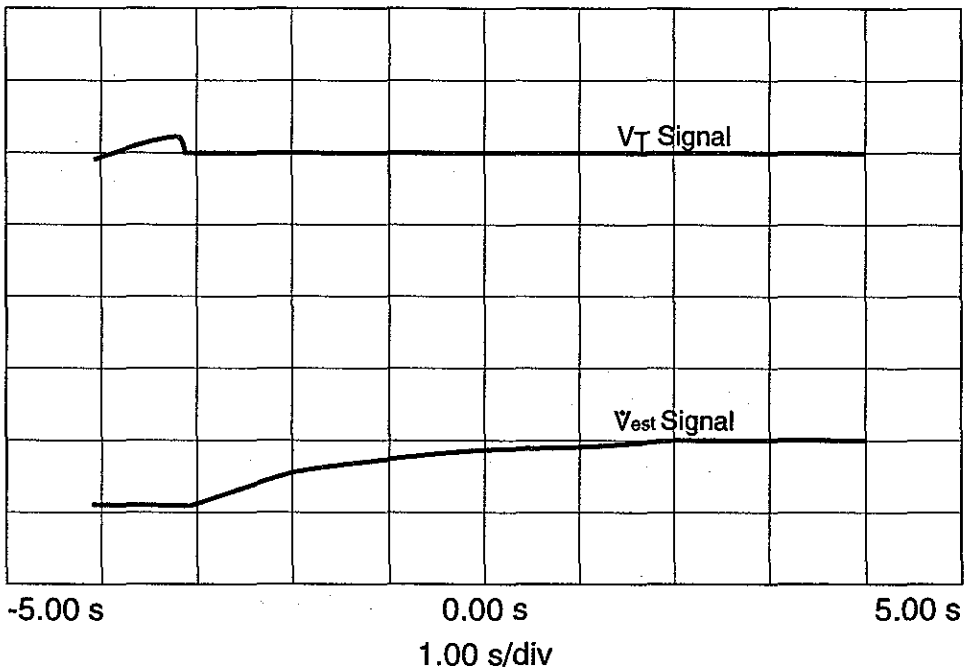


Figure 7-7. Spontaneous Mode, Ramp Up.

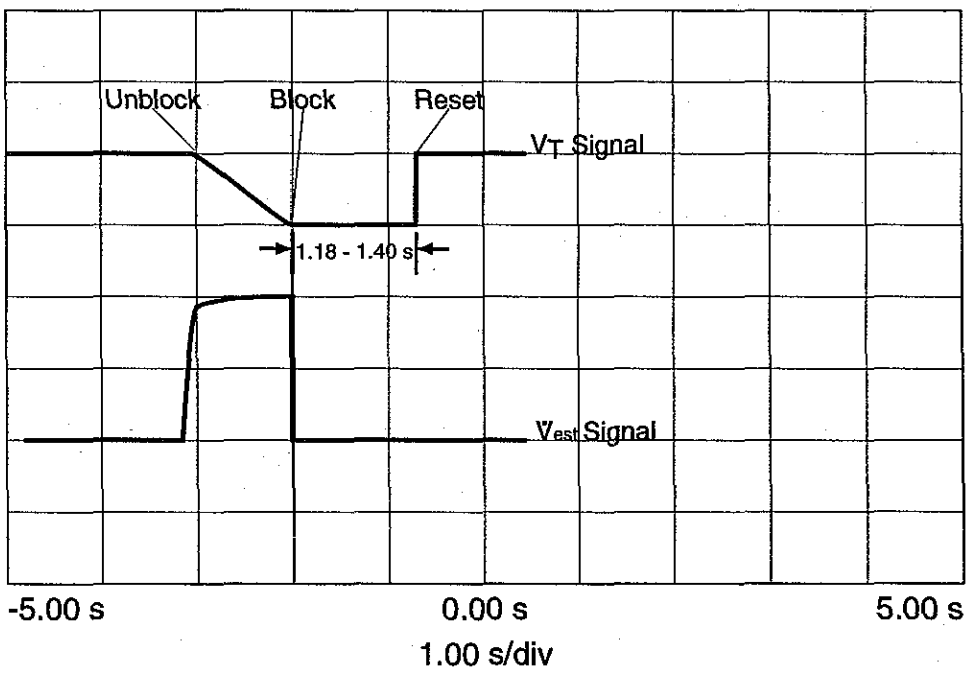


Figure 7-8. Spontaneous Mode.

NOTE: Traces shown are for BiPAP S and S/T. The plateau on the V_T signal goes upward on BiPAP S-D and S/T-D. The short plateau on the $\dot{V}_{est}$ signal goes upward on all units.

7.13 Spontaneous/Timed Mode Verification (S/T & S/T-D)

7.13.1 Test Equipment Set-up

Step 1 Connect Channel 1 of the oscilloscope to the I/E state signal (Pin 13 of the DCP cable connector or Pin 3 of the 8-pin connector) and Channel 2 of the scope to the $\dot{V}_{est}$ signal (Pin 4 of the DCP cable connector or Pin 4 of the 8-pin connector).

Step 2 Set up the scope channels as follows:
- Timebase: 5 sec/div
- Sensitivity: Channel 1—5 V/div
  Channel 2—500 mV/div
- Measure: period, duty cycle on Channel 1

Step 3 Remove the tubing from the outlet and install the 0.25" orifice on the outlet.

7.13.2 BiPAP Set-up

Step 1 Set the BiPAP selector switch to SPONTANEOUS/TIMED mode.

Step 2 Set the IPAP control knob to 12.

Step 3 Set the EPAP control knob to 4.

Step 4 Set the BPM control knob to 16.

7.13.3 Test Procedure

Step 1 Block and unblock the orifice faster than the BPM setting and note how the BiPAP unit switches between EPAP and IPAP respectively. The operation should be the same as in the Spontaneous mode.

Step 2 Block and hold the orifice closed and note that the unit automatically cycles. See Figure 7-9 for oscilloscope traces. Observe that a spike occurs in the I/E state signal when the timed pulse occurs and that the Spontaneous/Timed LED illuminates.

Step 3 The unit should continue to pulse the IPAP every 3.5 seconds ± 0.5 seconds as long as the orifice is blocked.

Step 4 Unblock and block the orifice more rapidly than the BPM rate (3.5 seconds) and note that the unit again operates the same as in the Spontaneous mode and that the Spontaneous/Timed LED is off.

Step 5 Observe that a timed pulse does not occur as long as the orifice is being blocked and unblocked faster than the BPM rate (3.5 seconds).

Step 6 Block the orifice and allow the unit to pulse.

Step 7 Store the display on the oscilloscope when it looks like Figure 7-9. Measure the distance between 2 timed pulses (spikes). The time should be 3.55 ± 0.5s.

Step 8 Mark pass or fail (P or F) on the data sheet.

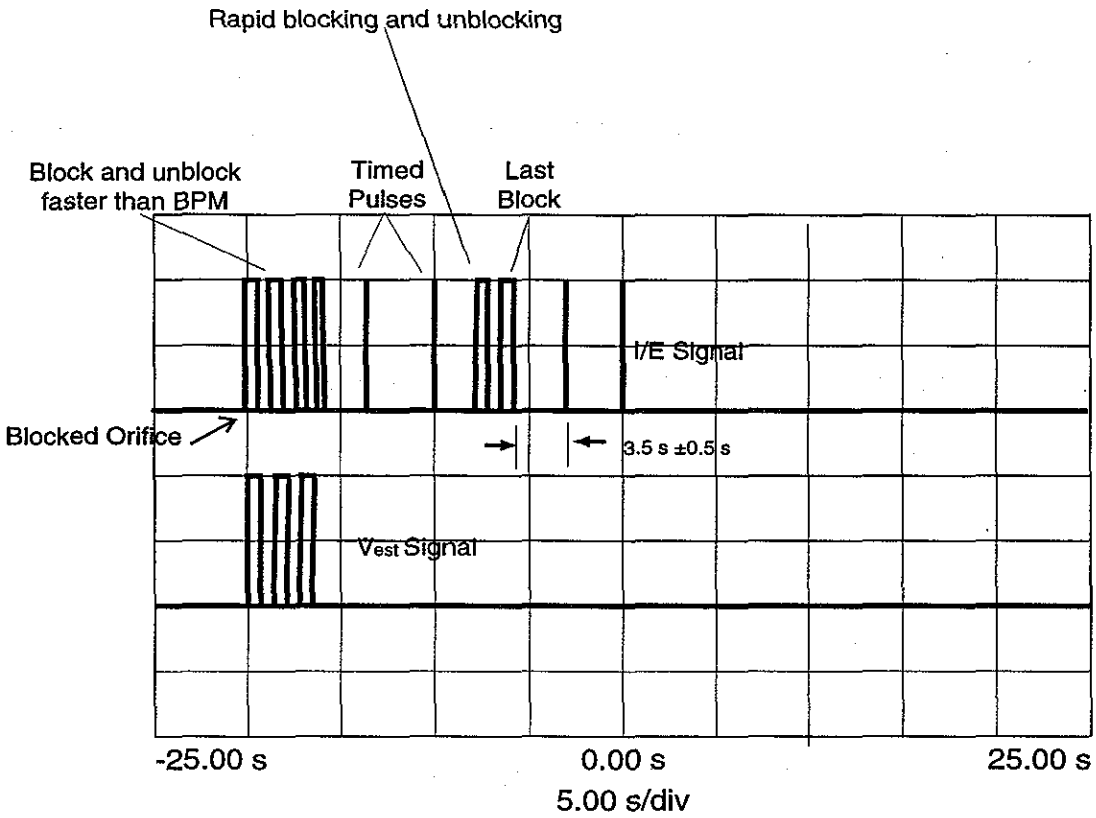


Figure 7-9. Spontaneous/Timed Mode.

7.14 Timed Mode Verification (S/T and S/T-D)

7.14.1 Test Equipment Set-up

Step 1 Connect Channel 1 of the oscilloscope to the I/E state signal (Pin 13 of the DCP cable connector or Pin 3 of the 8-pin connector).

Step 2 Set up the scope channel as follows:
- Timebase: 5 sec/div
- Sensitivity: Channel 1—5 V/div
- Measure: period, duty cycle on Channel 1

Step 3 Remove the tubing from the outlet and install the 0.25" orifice on the outlet.

7.14.2 BiPAP Set-up

Step 1 Set the BiPAP selector switch to TIMED mode.

Step 2 Set the IPAP control knob to 12.

Step 3 Set the EPAP control knob to 6.

Step 4 Set the % IPAP control knob to 50%.

Step 5 Set the BPM control knob to minimum (full counter-clockwise).

7.14.3 Test Procedure

Step 1 Verify and record that the I/E signal has a period of approximately 10 to 30 seconds.
Step 2 Adjust BPM to maximum.

Step 3 Change the timebase on the oscilloscope to 1 sec./div. (press "timebase"; "1"; "s/v")

Step 4 Press "Clear Display."

Step 5 Verify and record that the I/E signal has a period of approximately 1.8 to 2.2 seconds. See Figure 7-11.

Step 6 Adjust BPM to 16 and press "Clear Display."

Step 7 Set % IPAP to 10% (minimum setting) and verify and record that the I/E state has a duty cycle of approximately 10% (±5%). See Figure 7-13.

Step 8 Set % IPAP to 90% (maximum setting) and verify and record I/E state has a duty cycle of approximately 90% (±5%). See Figure 7-12.

Step 9 Verify that the control panel LEDs switch on and off as the unit switches between IPAP and EPAP.

Step 10 Mark pass or fail (P or F) on the data sheet.

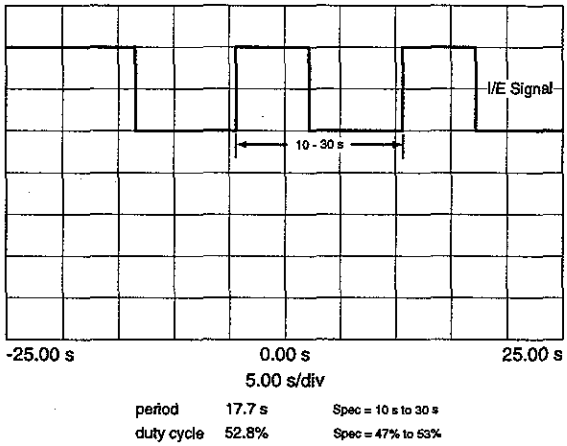


Figure 7-10. Timed Mode, BPM Min., %IPAP: 50%

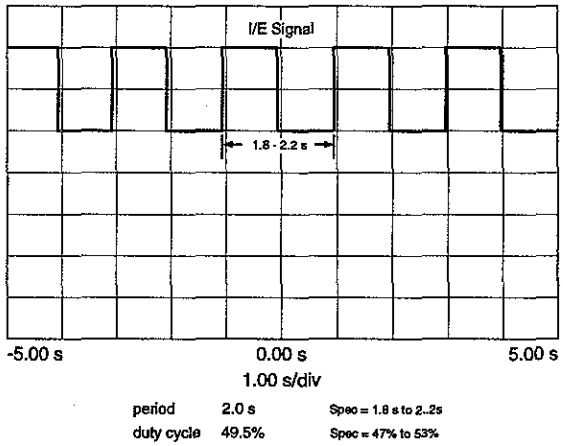


Figure 7-11. Timed Mode, BPM Max, %IPAP: 50%

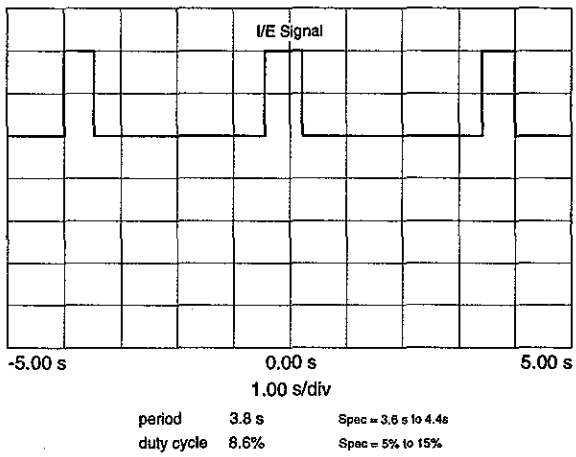


Figure 7-13. Timed Mode, BPM: 16, %IPAP: 10% ()Min)

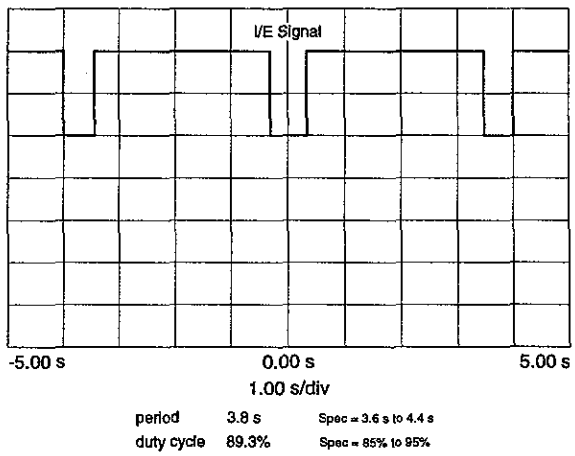


Figure 7-12. Timed Mode, BPM: 16, %IPAP: 90% (Max)

7.15 Verify Zero Function (S-D and S/T-D)

7.15.1 Test Equipment Set-up

Step 1 Connect Channel 1 of the oscilloscope to the $\dot{V}_{est}$ signal (Pin 4 of the DCP cable connector). Connect Channel 2 of the oscilloscope to theV_T signal (Pin 12 of the DCP cable connector).

Step 2 Set up the scope channel as follows:
- Timebase: 1 sec/div
- Sensitivity: Channel 1—500 mV/div
  Channel 2—500 mV/div
- Measure: Period, duty cycle on both channels

7.15.2 BiPAP Set-up

Step 1 Set the BiPAP selector switch to ZERO.

7.15.3 Test Procedure

Step 1 Verify that the $\dot{V}_{est}$ signal and V_T signal are at 0 VDC ±0.01V.

Step 2 Disconnect channel 1 from $\dot{V}_{est}$. Connect channel 1 to the Pressure signal. Disconnect channel 2 from V_T . Connect channel 2 to the $\dot{V}_{tot}$ signal.

Step 3 Verify that the pressure signal and V_T signal are at 0 VDC ±0.01V.

Step 4 Mark pass or fail (P or F) on the data sheet.

NOTE: The I/E signal does not go to zero in this mode.

7.16 Verify Calibrate Function (S-D and S/T-D)

7.16.1 Test Equipment Set-up

Step 1 All test equipment should be the same as for 7.15.

7.16.2 BiPAP Set-up

Step 1 Unblock the outlet.

Step 2 Set the Selector knob to IPAP for 2 seconds +2 -0 seconds, then switch to CALIBRATE.

7.16.3 Test Procedure

Step 1 Watch $\dot{V}_{est}$ and V_T traces as they adjust toward a steady state (the triangle wave must not have any 'breaks' in the trace).

Step 2 When a steady state is attained in approximately 20 seconds, $\dot{V}_{est}$ should be a square wave of +0.5V to -0.5V amplitude, 50% duty cycle, 4 sec. period; V_T should be a triangle wave of 0.5 V_{pp} with 50% duty cycle and 4 sec. period. See Figure 7-14.

Step 3 Mark pass or fail (P or F) on the data sheet.

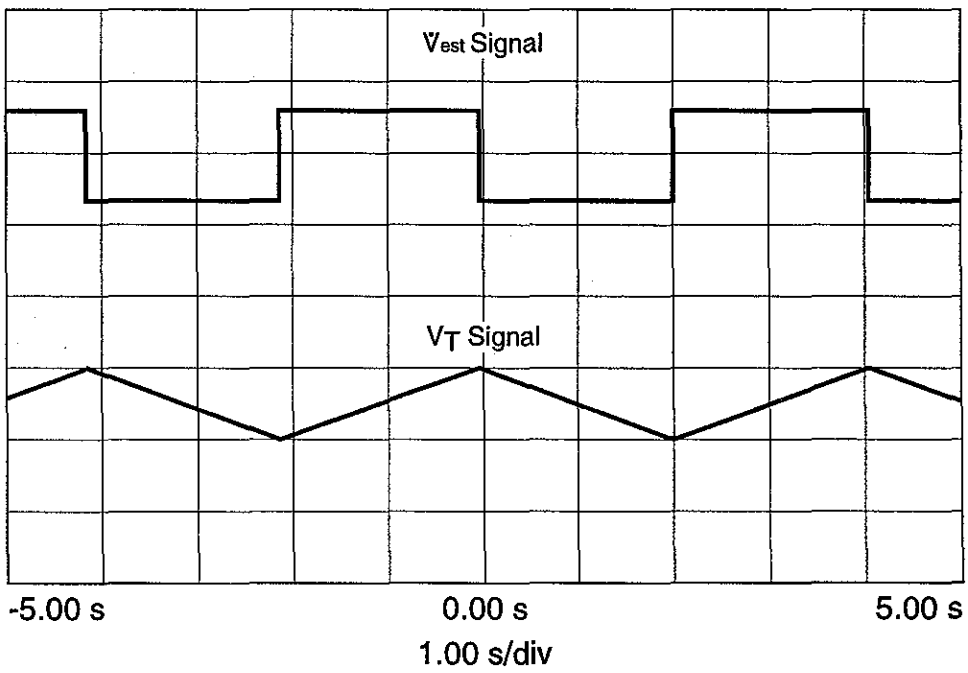


Figure 7-14. Calibration Signals.

7.17 DCP Verification (S-D and S/T-D)

7.17.1 Test Equipment Set-up

Step 1 All test equipment should be the same as for 7.13.

7.17.2 BiPAP Set-up

Step 1 Connect the BiPAP unit to the Detachable Control Panel with the proper cable.

7.17.3 Test Procedure

Step 1 Verify that the Rear Panel Controls are inactive.

Step 2 Verify that the DCP Zero sets all signals to 0V.

Step 3 Verify that the DCP Cal. sets Flow, Flow est to ±0.5V square waves and volume to $0.5V_{pp}$ triangle wave.

Step 4 Verify that the IPAP mode allows the IPAP control to operate and that the IPAP LED illuminates.

Step 5 Verify that the EPAP mode allows the EPAP control to operate and that the EPAP LED illuminates.

Step 6 Verify that the SPONTANEOUS mode operates by blocking and unblocking the orifice.

Step 7 Verify that the SPONTANEOUS/TIMED mode operates like the Spontaneous mode by blocking the orifice and verifying that the unit emits timed pulses.

Step 8 Verify that the TIMED mode allows BPM and %IPAP controls to operate with IPAP at 12 and EPAP at 6.

Step 9 Mark pass or fail (P or F) on the data sheet.

Step 10 Turn off the unit and disconnect the power cord test cable and any tubing or test orifice.

NOTE: Some units may use the Remote Control Unit (RCU). All information regarding the DCP is applicable to the RCU.

7.18 Corrective Actions

In case of a failure during the System Set-up or Final, use the following table for corrective actions.

TEST FAILURE	CORRECTIVE ACTIONS
Blower Pressure (Section 7.3)	1. Check for air leaks. 2. Try resetting the motor speed per the calibration procedure 7.3. 3. If you are unable to set the motor speed, replace the Motor Control Board (See Section 6.2.3).
Flow Calibration (Section 7.4)	1. Reset the flow calibration. 2. If the flow calibration fails after resetting then replace the blower assembly (See Section 6.2.2).
Valve Calibration (Section 7.5)	1. Reset R84 for 20.5 cm H_2O per the calibration procedure for the valve calibration. 2. Retest. 3. If the valve calibration fails again, replace the BiPAP Control Board (BCB) (See Section 6.2.4).
Pressure vs. Flow (Section 7.5)	1. If the test fails at 18 cm H_2O at 100 L/min flow, replace the valve (See Section 6.2.7). 2. If the test fails at all 100 L/min settings, then check the flow calibration. If the flow calibration is within specs, replace the BCB (See Section 6.2.4).
Pressure monitor (Section 7.6)	1. Reset per calibration procedure (7.6). 2. If the unit still fails, replace the BCB (See Section 6.2.4).
Trigger (Section 7.9)	1. Check for leaks anywhere in the system. 2. Replace the Valve (See Section 6.2.7) 3. Replace the BCB (See Section 6.2.4). 4. Replace the Blower (See Section 6.2.2).
Spontaneous (Section 7.12), Spontaneous/Timed (Section 7.13), Timed (Section 7.14), Zero Tests (Section 7.15), or Calibrate (Section 7.16).	Replace the BCB (See Section 6.2.4).

Chapter 8 Parts List and Exploded View

8.1 Wraparound Assembly

8.2 Exploded View

8.3 Exploded View—Foam Panels

8.1 Wraparound Assembly

See Figure 8-1 for corresponding Index numbers. Replacement kits contain the described part and ancillary parts.

Index # From Dwg.	Reorder RP Kit Number	Description
1	332183	BiPAP Wraparound, Repair Kit
2	332184	Molded Accessory Cap
3	362358	Screw-on Feet, Recessed
4	332221	Accessory Cap Latches, Repair Kit

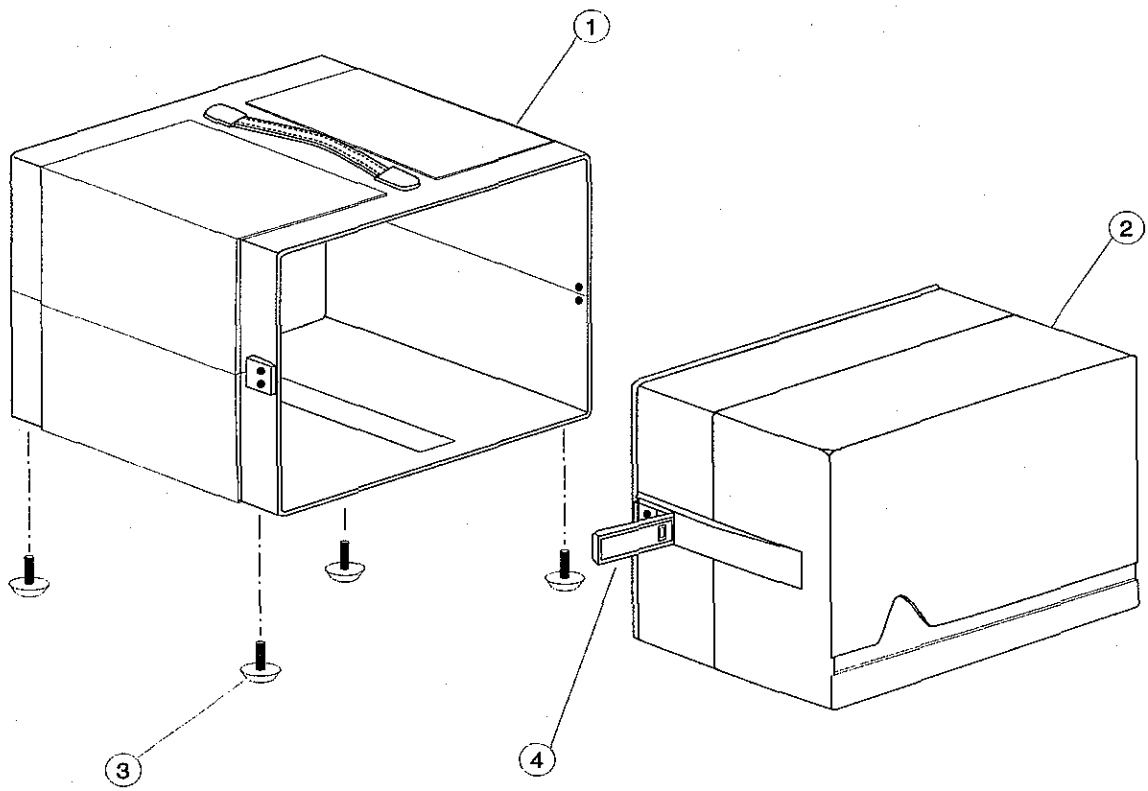


Figure 8-1

8.2 Exploded View

Refer to Figure 8-2 for corresponding Index numbers. Replacement kits contain the described part and ancillary parts. Replacement kits are shown in bold.

Index # From Dwg.	Reorder RP Kit Number	Description
1	302064	Filter, Disposable (Pkg. of 6)
2	332160	Front End Cap, S/T-D Units, Repair Kit
2	332161	Front End Cap, S/T Units, Repair Kit
2	332224	Front End Cap, S-D Units, Repair Kit
2	332222	Front End Cap, S Units, Repair Kit
3	332162	Pressure Port, Repair Kit
4	332163	Main Power Switch, Repair Kit(green, translucent, lighted)
4	552127	Main Power Switch, Repair Kit (black, opaque, non-lighted)
5		Tubing Clamp (2 in flex connector)
6		Tie Wraps (in various kits as needed)
7	332165	Flexible Connector, Repair Kit
8	332471	Muffler, Repair Kit (tubular replaces tan box)
9	332167	Pressure Control Valve, Repair Kit
10	332170	BiPAP Control Board S/T-D Unit, Repair Kit (BCB)
10	332141	BiPAP Control Board S-D Unit, Repair Kit (BCB)
10	332169	BiPAP Control Board S-TUnit, Repair Kit (BCB)
10	332168	BiPAP Control Board S Unit, Repair Kit (BCB)
11	332172, 332553	BiPAP Conrol Board Repair Kit (MCB)
12	332175, 332555	Voltage Selector Switch, Repair Kit
13	332176	Time Meter, Repair Kit
14	332214, 332556	AC Inlet with Fuse Drawer, Repair Kit
15		**115 VAC Applications (pkg. of 2)**
	332120	Fuse, 1A, 240V, 5mm x 20mm Time Lag for SN <200,000 **or**
	362523	Fuse, 800mA, 250V, 5mm x 20mm Time Lag for SN>200,000
15		**230 VAC Applications(pkg. of 2)**
	332121	Fuse, 500mA, 240V, 5mm x 20mm, Time Lag - SN<200,000 **or**
	532163	Fuse, 400mA, 250V, 5mm x 20mm Time Lag for SN>200,000
16	332177	Control Knobs, D Shaft (Set of 5), Repair Kit
16	332218	Control Knobs, Round Shaft (set of 5), Repair Kit
17	332533	Coupling Kit
18	332180, 332554	Transformer, Repair Kit
19	332181	Blower Assembly, Repait Kit
20		Air Bellows (in various kits)
21	332173	Blower Shock Mount, Repair Kit (pkg of 4)
22	332174	Feet, stick-on (pkg. of4)
23	332185	Flow Pick-up Tube, Repair Kit
24		Rear End Cap*
25	332302	Crowbar Fuse, 500mA Slo-Blo, Repair Kit (pkg. of 2)
Not Shown	332422	Blower Connector, Repair Kit (connector and leader)
Not Shown	332302	Fuse, Internal Crowbar (2/pk)
Not Shown	332204	Service Manual
Not Shown	332301	Small Tool Kit
Not Shown	332353	"T" and Adaptor
Not Shown	332300	Trigger Test Fixture
Not Shown	332389	Whisper Cap TM5

* Due to labeling considerations, contact our Customer Service Department for units that require end cap replacement.

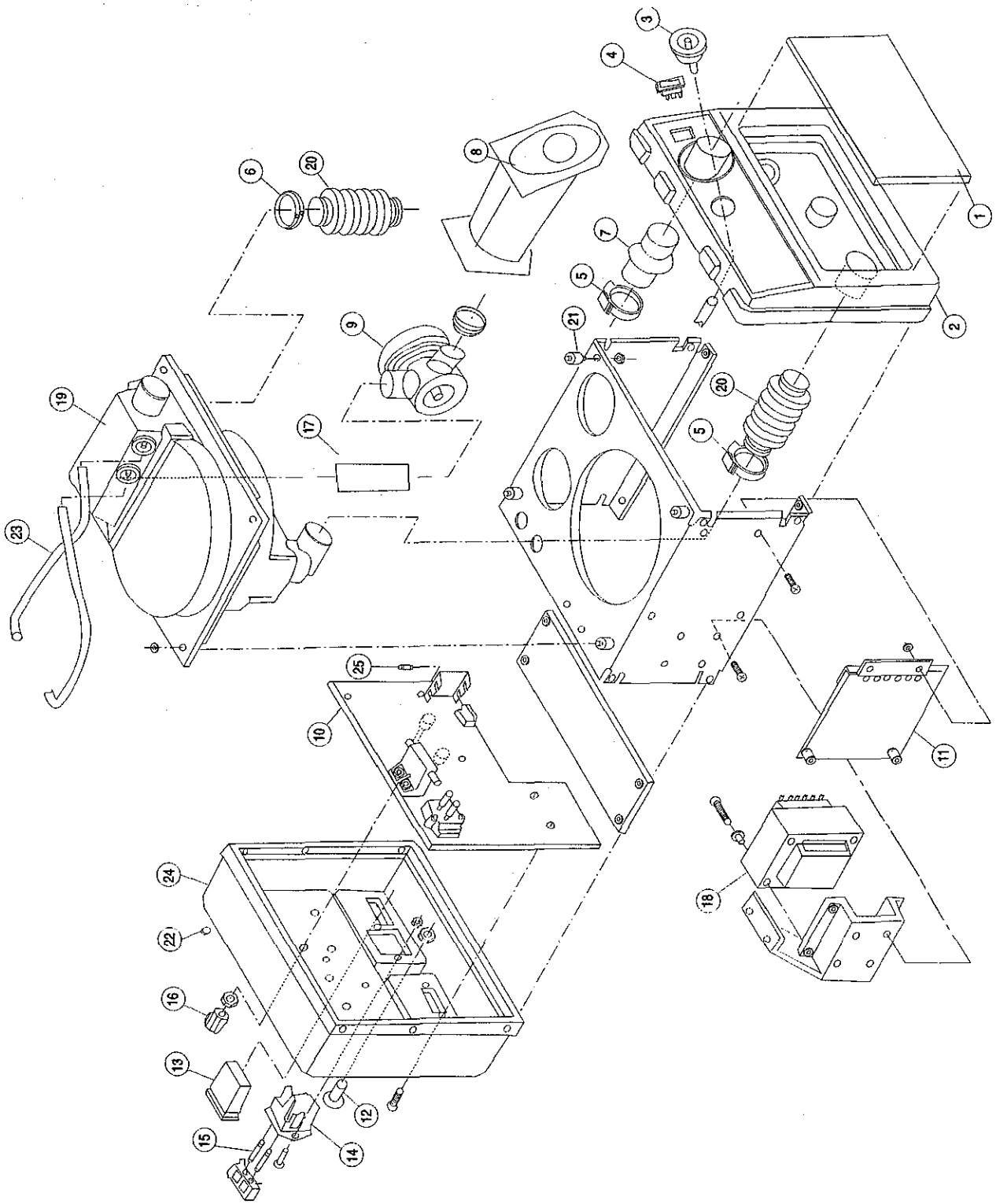


Figure 8-2

8.3 Exploded View—Foam Panels

Refer to Figure 8-3 for Index numbers corresponding to the numbers in the following table. Replacement kits contain the described part and hardware as necessary. See Chapter 6 for the complete kit contents.

Index # From Dwg.	Reorder RP Kit Number	Description
1	332440	BiPAP Top Plate
2	332443	BiPAP Side Panels (Reminder: These side panels replace the cross bars in older units.)
3	332445	BiPAP Bottom Plate

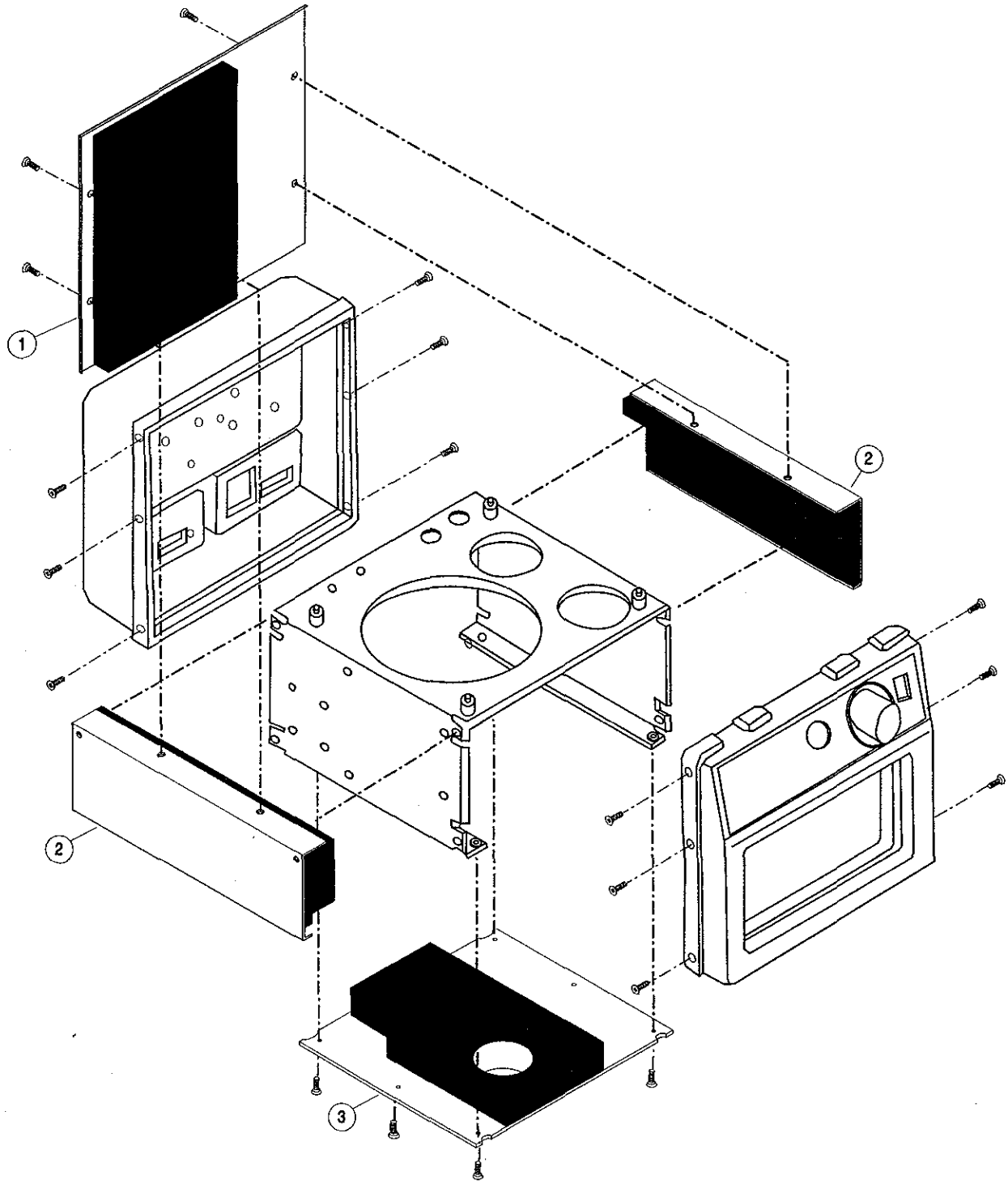


Figure 8-3

Appendix A Required Tools and Equipment

A.1 Service Tools

A.2 Service Supplies

A.3 Acceptable Electronic Test Equipment

A.1 Service Tools

You should have the following tools available for troubleshooting, testing, and repairing the BiPAP unit.

- Common hand tools:
  Flat-blade screwdrivers — at least a small, medium, and large
  Phillips screwdrivers— at least a small and medium
  Nut driver set —3/16" to ½"
  Hex wrench set — 1/16" to ½"
  Putty knife, 1" to 2" wide, with sharp edge, for scraping foam
  Straight/open end wrench set, 3/16" to ½"
  Scissors
  Needle-nose pliers, at least small, medium, and large
  Diagonal cutters, at least small, medium, and large
  Vise-grip set, at least small, medium, and large
  Razor blade knife
- Water column manometer with at least 6' of tubing (optional for trouble-shooting)
- Thermometer — 32°F to 110°F, readable to 0.5°F
- Ruler
- Tie wrap gun
- Anti-static work station — Minimum requirement is a grounded mat and wrist strap
- Digital manometer — Capable of making required measurements.
- Hot melt glue gun
- Watt meter — See Section A.3
- Digital multimeter — Amprobe AM12 or equivalent
- Flowmeter — See Section A.3
- Oscilloscope — See Section A.3
- Trigger test fixture (requires 50+ psi external air source) — Respironics part number 332300
- Tubing, 6' smooth inner lumen — Respironics part number 301016
- BiPAP small tool kit — Respironics part number 332301—including:
  Adjustable valve (Respironics part number 331461)
  Tubing coupler (Respironics part number 300176)
  Two O_2 enrichments (Respironics part number 312710)
  Test adaptor — 0.25" (Respironics part number 332353)
  Allen wrench (0.050) (Respironics part number 331462)

A.2 Service Supplies

You should have the following supplies available:

- Paper towels
- Disposable gloves
- Cleaner (i.e. Fantastik®, 409®, etc.)
- Denatured alcohol
- Loctite 222® removable thread locker
- Sicomet® 8300 glue
- Hot melt glue
- Tie wraps (3" x ⅛" and 6" x 3⁄16")
- Cable clips (Stick-on base 1" x ½" holds cable up to ½" diameter)

A.3 Acceptable Electronic Test Equipment

A.3.1 Flowmeter

Specifications: 0 to 150 L/min
3% accuracy
1 L/min resolution

Acceptable options:
1. Respironics System (RI in-house and limited field use only)
2. CME 422-5-200A (SP-1)
3. RT-200 with some limitations

A.3.2 Oscilloscope

Specifications: 2 Channel
Storage
Timebases with 1 sec/div and 5 sec/div
Sensitivities of 500 mV/div and 5 V/div

Acceptable options:
Any commercially available oscilloscope that meets the above specifications

A.3.3 Digital Manometer

Specifications: 0 to 35 cm H_2O
±0.3 cm H_2O accuracy
±0.1 cm H_2O resolution

Acceptable options:
1. Respironics 302227 Digital Manometer
2. Merical DP2001
3. Sensym PDM 200CD
4. RT-200
5. Any commercially available manometer that meets the above specifications

A.3.4 Wattmeter

Specifications: 0 to 100 W
3% accuracy
1 W resolution

Acceptable options:
1. Yokogawa 2355 (digital)
2. Simpson, Analog 0 to 150 W
3. Extech DW 6060
4. Any commercially available manometer that meets the above specifications

Appendix B Data Sheets

This Appendix contains the Respironics forms that you must fill out as part of various tasks. The following forms are included:

1. System Data Sheet — Use one side for adjustment and the second side for the Final
2. Respironics Recommended Preventative Maintenance Schedule

These forms may be reproduced as needed for servicing a unit.

BiPAP 20 System Data Sheet (Adjustment)

Blower Pressure

100 lpm Flow @ 20 cm H_2O ±2 ☐

Dead Head Pressure ☐

Flow Calibration

LPM	0	30	60	90	120
V (Vdc)					
Specs	(-).035-.034V	.350-.640V	.850-1.14V	1.15-1.85V	1.55-2.44V

Valve Calibration

	Minimum	6	12	18	20
IPAP					
EPAP					
Specs	<2.5 cm H_2O	3.5-8.4 cm H_2O	9.5-14.4 cm H_2O	15.5-20.4 cm H_2O	17.5-22.4cm H_2O

Pressure vs. Flow

IPAP Control	50 LPM	100 LPM
6 4.5-6.75 cm H_2O		
12 10.5-12.75 cm H_2O		
18 16.5-18.75 cm H_2O		

Pressure Monitor S-D, S/T-D

Pressure (cmH_2O)	0	5	10	15	20
P- meter (Vdc)					
Specs (Vdc)	0.0 -.14	.35-.64	.85-1.14	1.35-1.64	1.85-2.14

AC Watts

Blocked		Watts
Unblocked		Watts(<85)
Hour Meter		Hours

Comments:

Adjust

PASS

FAIL

Serial No.:

Tested By:

Date Tested:

RESPIRONICS INC.®

BiPAP 20 System Data Sheet (Final)

Blower Pressure

100 lpm Flow @ 20 cm H_2O ±2 [ ]

Dead Head Pressure [ ]

Flow Calibration

LPM	0	30	60	90	120
V̇ (Vdc)					
Specs	(-).035-.034V	.350-.640V	.850-1.14V	1.15-1.85V	1.55-2.44V

Valve Calibration

	Minimum	6	12	18	20
IPAP					
EPAP					
Specs	<2.5 cm H_2O	3.5-8.4 cm H_2O	9.5-14.4 cm H_2O	15.5-20.4 cm H_2O	17.5-22.4cm H_2O

Pressure vs. Flow

IPAP Control	50 LPM	100 LPM
6 4.5-6.75 cm H_2O		
12 10.5-12.75 cm H_2O		
18 16.5-18.75 cm H_2O		

Pressure Monitor S-D, S/T-D

Pressure (cmH_2O)	0	5	10	15	20
P- meter (Vdc)					
Specs (Vdc)	0.0 -.14	.35-.64	.85-1.14	1.35-1.64	1.85-2.14

AC Watts

Blocked		Watts
Unblocked		Watts(<85)
Hour Meter		Hours

Spontaneous

1.18-1.40sec [ ]

Timed

BPM Min. (10-30)sec	BPM Max. (1.8-2.2 sec)	% IPAP Min. (5-15%)	% IPAP Max. (85-95%)

Pass or Fail

	S	S/T	S/T - D	S - D
	Pass/Fail	Pass/Fail	Pass/Fail	Pass/Fail
Trigger				
Spon. Timed				
Timed				
Zero				
Calibrate				
Remote				

Comments:

RESPIRONICS INC.®

FINAL

PASS

FAIL

Serial No.:

Tested By:

Date Tested:

Appendix C BiPAP Screening Procedure

NOTE: This procedure and worksheet are optional. As explained during BiPAP service training, they can be used for:

1. Training people on how the unit is supposed to function.

2. "Screening" or checking a new unit that has just been received. (Some hospitals use this procedure as their "check-out" procedure. Some international dealers use this procedure as their "import check-out.")

3. A quick troubleshooting guide. The procedure can be performed with just the unit and a hook-up to a manometer. (The cover does not have to be removed, an anti-static work station is not needed, and special test equipment is not needed.)

4. As a preventative maintenance test.

Step 1 Verify that the voltage selector switch is set for the available line voltage.

Step 2 Verify that the fuses are the correct value.

Step 3 Plug the unit into a wall outlet, turn it on, and allow it to warm up for a few minutes.

Step 4 This step verifies the basic IPAP mode function. Set the unit to the IPAP mode. Set the IPAP control to the lowest setting. Connect a water column manometer to any combination of fittings, hoses, etc. that allows the measurement of deadhead pressure. Slowly and smoothly adjust the IPAP pressure upward. The pressure on the manometer should be ±2 cm H_2O of the pressure setting on the control panel. When the entire range from 4 to 20 cm H_2O has been verified, reduce the IPAP pressure to minimum.

Step 5 This step verifies the basic EPAP mode function. Repeat Step 4 using the EPAP control instead of the IPAP control.

Step 6 Remove the fittings, hoses, and manometer.

Step 7 This step verifies the basic triggering and "lock-out" features of the Spontaneous mode. Set the unit to the Spontaneous mode. Set the IPAP control to 8 and the EPAP control to 4. Use your hand to open and close the outlet port several times, simulating a person breathing. Observe the IPAP and EPAP lights to verify that the unit is following the breathing pattern that your hand is creating. While continuing the breathing pattern, gradually turn the EPAP control to 12. Verify that as the EPAP value becomes higher than the IPAP value, the unit locks out; i.e., defaults to the lower pressure value, which is now IPAP, and no longer follows the breathing pattern.

Continue the breathing pattern and gradually turn the IPAP control to 16. Verify that as the IPAP value exceeds the EPAP value, the unit once again follows the breathing pattern. The exact point of the lock-out can vary, since the pressure controls are specified to be ±2 cm H_2O. The lock-out feature may also be observed at other pressure control settings, within the specified 4 to 20 cm H_2O BiPAP operating range (i.e., the units may be capable of lower and/or higher pressures, but the units' triggering, lock-out, and other behaviors are not assured outside of that range).

Step 8 This step verifies the default and restart of the Spontaneous mode. Set the unit to the Spontaneous mode. Set the IPAP control to 12 and the EPAP control to 5. Use your hand to open and close the outlet port, simulating a person breathing. Stop the pattern with the port closed. The unit should stop at the EPAP pressure. Restart the pattern of opening and closing. The unit should once again follow the breathing pattern within 3 cycles of the restart.

NOTE: If you stop the pattern with the outlet open, the unit may self-cycle and eventually stop at the EPAP pressure, or the unit may stop at the IPAP pressure. Either behavior is acceptable, since operation in the Spontaneous mode when there is no spontaneous triggering, and with a wide-open leak, does not occur in actual use of the system.

Step 9 **S/T or S/T-D units only** — This step verifies the basic function of the Spontaneous/Timed mode. Set the unit to the S/T mode. Set the IPAP control to 12, the EPAP control to 5, and the BPM to 20. Use your hand to open and close the outlet port several times. Stop this cycling and leave the port closed. The unit should default to the EPAP pressure; after 3 seconds (corresponding to 20 BPM) the unit should produce an assist "shot" of air. Keep the outlet closed. The unit should remain at the EPAP pressure, producing a shot of air every 3 seconds. Check this operation at several BPM settings.

Step 10 **S/T or S/T-D units only** — This step verifies the basic function of the Timed mode. Set the unit to the Timed mode. Set the IPAP control to 12, the EPAP control to 5, the BPM to 20, and the % IPAP to 50. The unit should cycle between IPAP and EPAP based strictly on the BPM and % IPAP settings. The BPM should be ±10% or ±2%, whichever is greater. % IPAP should be ±5%. Verify the operation at several IPAP, EPAP, BPM, and % IPAP settings. Use your hand to close and open the outlet port. Occluding and opening the port should not affect the cycling.

BIPAP 20 SCREENING PROCEDURE WORKSHEET

Serial No._____ Date: _____

Comments: _____

_____

Hour meter reading: _____ Unit Model (circle): S S/T S-D S/T-D

Normal Unit Settings:

Mode: _____

IPAP: _____ BPM: _____

EPAP: _____ % IPAP: _____

Initial Checks:

Steps 4 and 5 Pressures:

	IPAP and EPAP Control Settings				
	4	8	12	16	20
Manometer Readings					
IPAP					
EPAP					

Basic function of each mode:

Step 7. Spontaneous, Lock-out of IPAP, EPAP ..... ☐

Step 8. Spontaneous, default to EPAP, restart ≤3 cycles ... ☐

Step 9. S/T, cycles, assist shot of air ..... ☐

Step 10. T, indep. switching, approx. BPM and % IPAP .. ☐

Further checks, tests, and comments: _____

_____

_____

Date: _____ Initials: _____

Appendix D DC Operation

D.1 D C Operation
D.2 Specifications

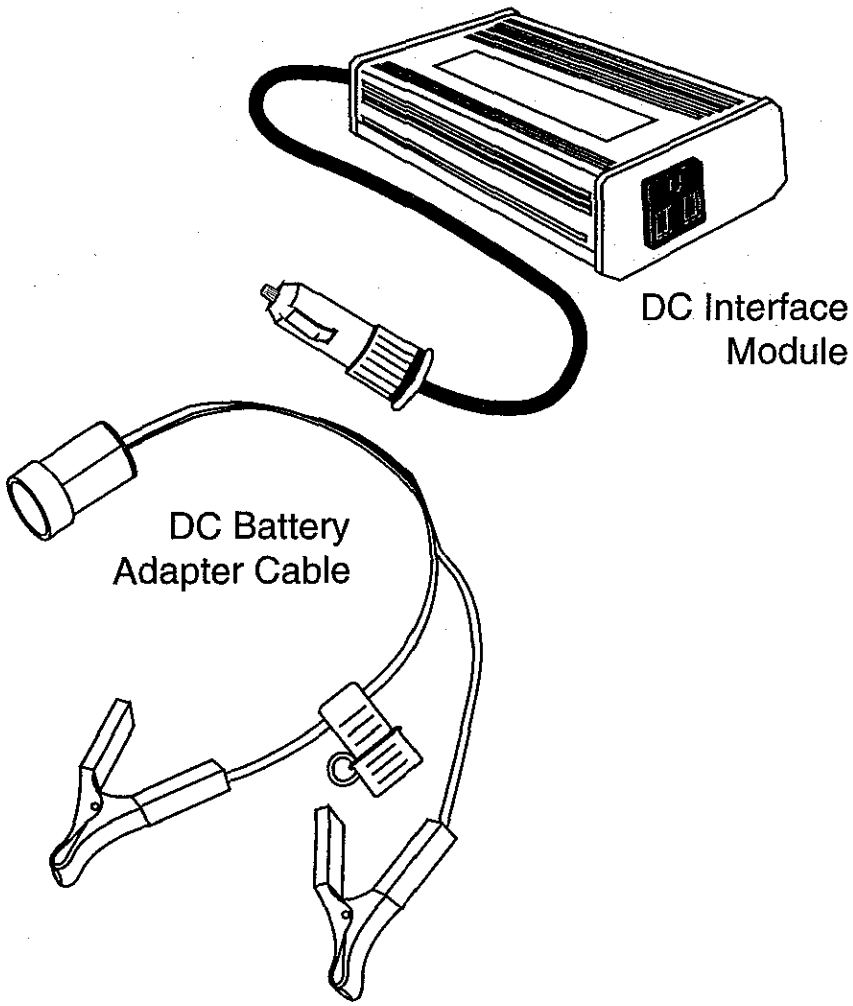
D.1 DC Operation

The BiPAP 20 System may be used with a Respironics DC Interface Module, Part Numbers:

Part #	Description
552097	DC Interface Module
532209	Battery Adapter Cable
532105	DC Interface System, North American
Includes:	1 ea. DC Interface Module
	1 ea. Battery Adapter Cable

NOTE: For a 220 volt DC System, contact Customer Service

The figures below illustrate the interface module electrical connection to a battery and to an automobile cigarette lighter. The specifications for the module and for the battery required for operation are on the following page.



D.2 Specifications

Voltage In: 11.5 - 15 VDC

Voltage Out: 115 VAC rms ±5%

When measuring the output voltage, use a true rms-indicating voltmeter to obtain an accurate reading.

Continuous Power: 150 watts

Output Frequency: 60 Hz ± 1%

Efficiency: 90%

Battery Use: Recommend a 12 VDC 100 amp•hour deep cycle marine type battery.

System	Pressure Setting	Battery Size	Length of Operation	Approximate Current Draw
BiPAP 20 System	**all pressures**	**100 amp-hr**	**up to 8 hrs.**	**7.2 - 9.5 amps**

NOTE: Length of operation times are based on normal operating conditions from a fully charged, deep cycle marine-type battery. Battery age, number of recharging cycle, and recharging rates may affect the actual length of operating times.

Appendix E: BiPAP 20 System Schematics

E.1 WiringDiagram
E.2 Schematic Statement

E.1 Wiring Diagram

Section 5.2 of this manual contains a wiring diagram that shows the major subassemblies of the BiPAP System. This is the level to which service is performed.

E.2 Schematic Statement

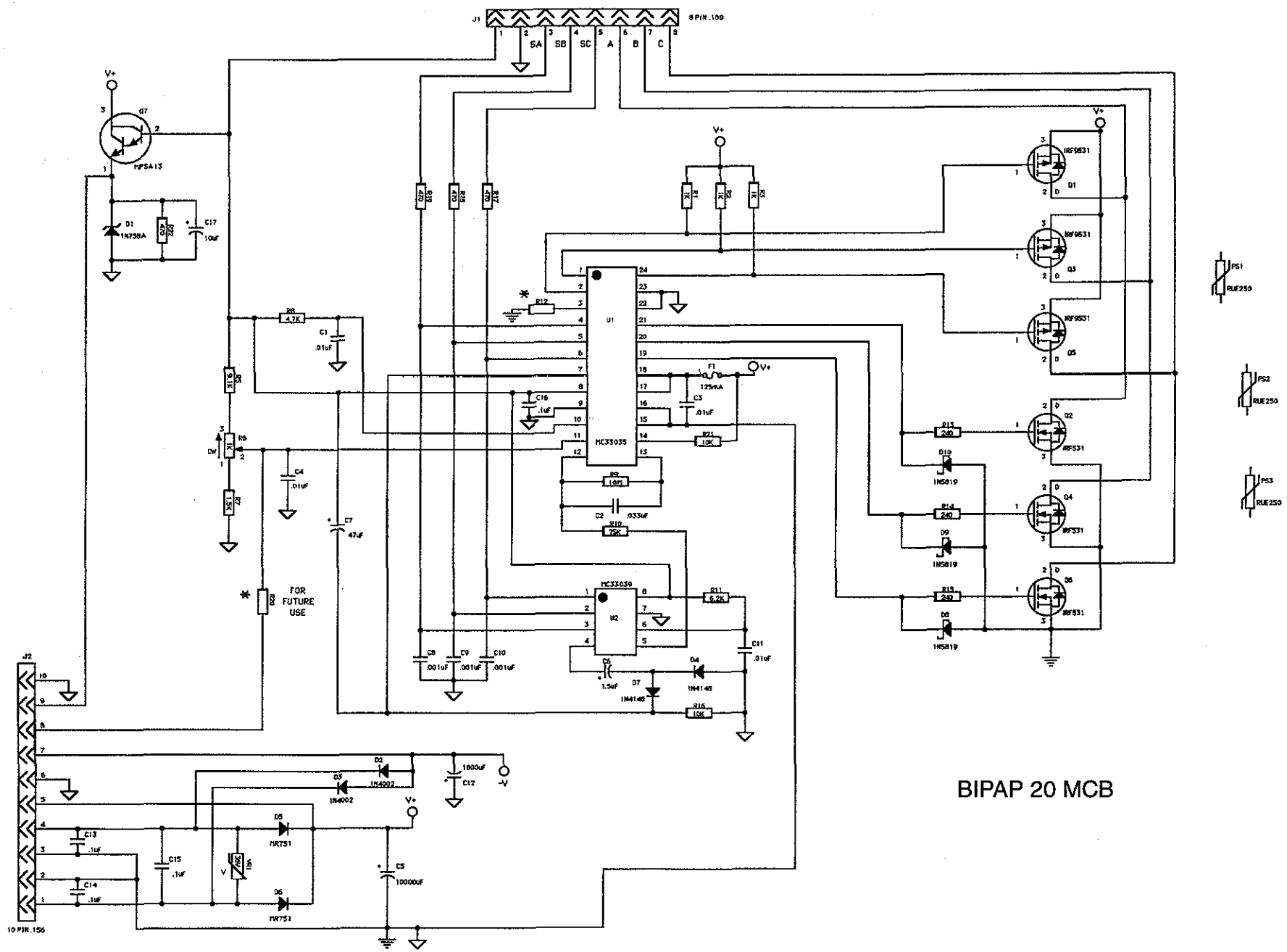
Schematics are supplied with this manual in direct support of the sale and purchase of this product.

The schematics are *proprietary* and *confidential.* Do not copy the schematics or disclose them to third parties beyond the purpose for which they are intended.

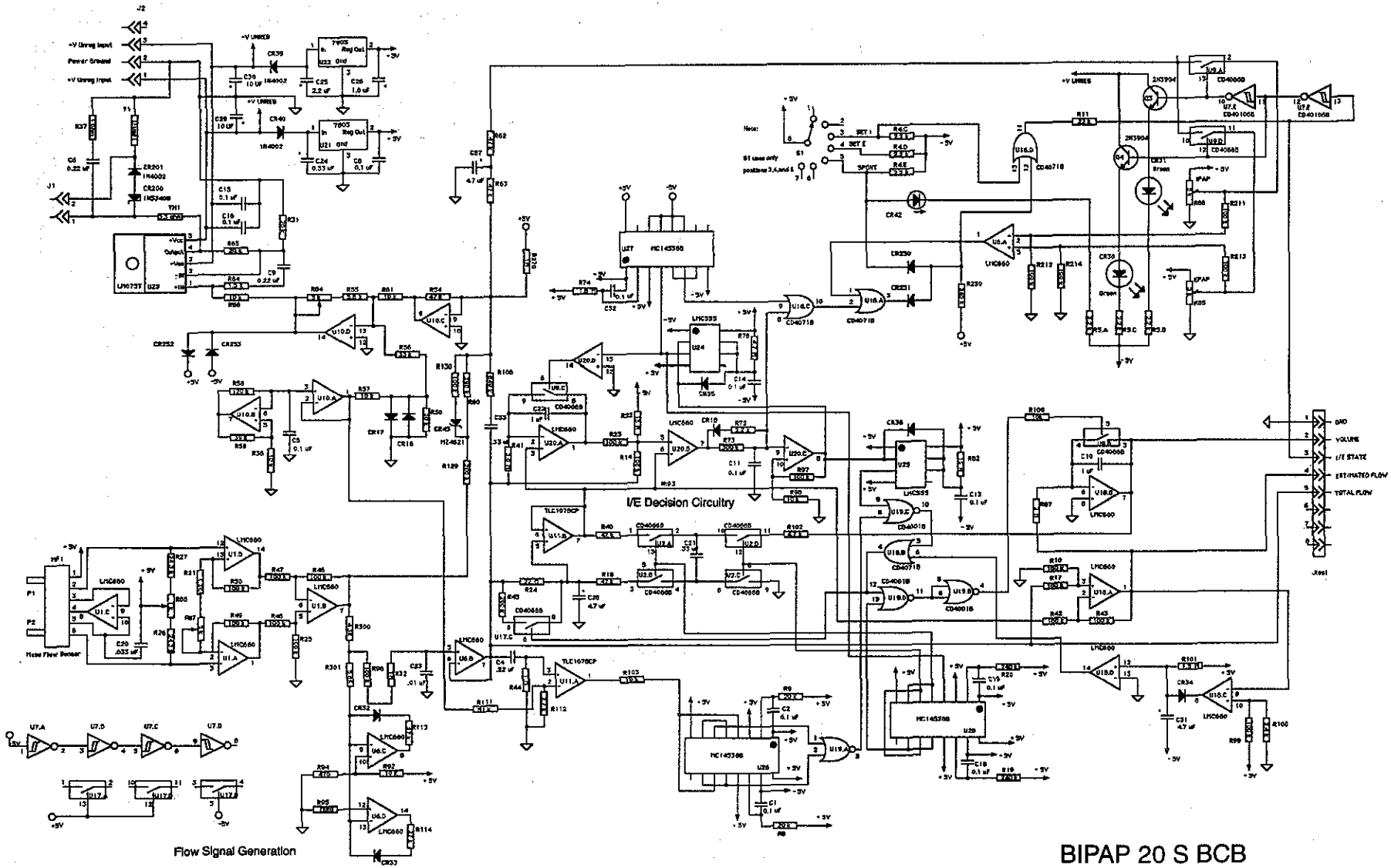
The schematics are intended to satisfy administrative requirements only. They are not intended to be used for component level testing and repair. Any changes of components could affect the reliability of the device, prohibit lot tracking of electronic components, and void warranties. Repairs and testing are supported only at the complete board level.

The schematics are of the revision level in effect at the time that this manual was last revised. New revisions may or may not be distributed in the future.

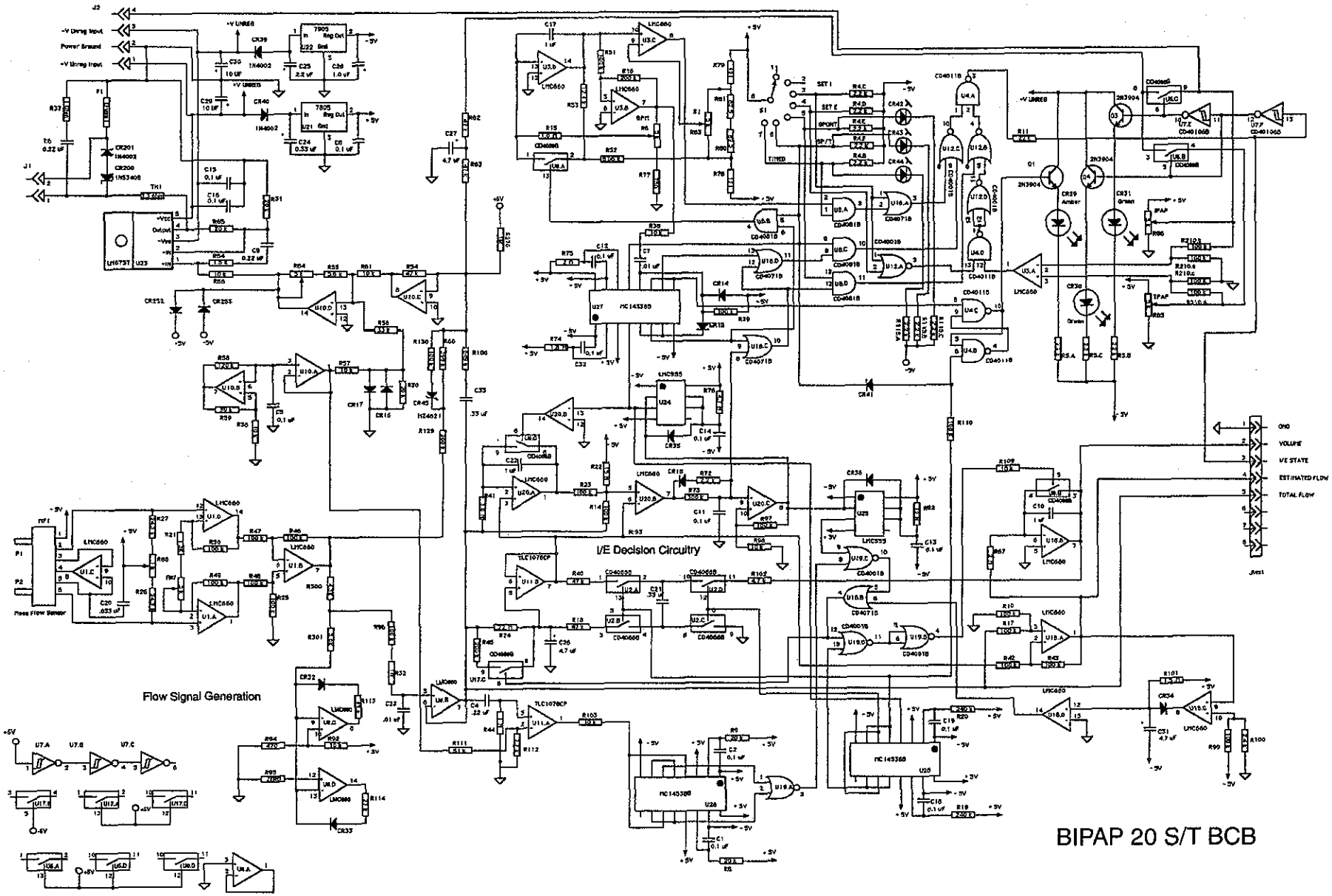
The schematics are presented in the following order: BiPAP 20 MCB, BiPAP 20 S BCB, BiPAP 20 S/T BCB, BiPAP 20 S/T-D BCB.

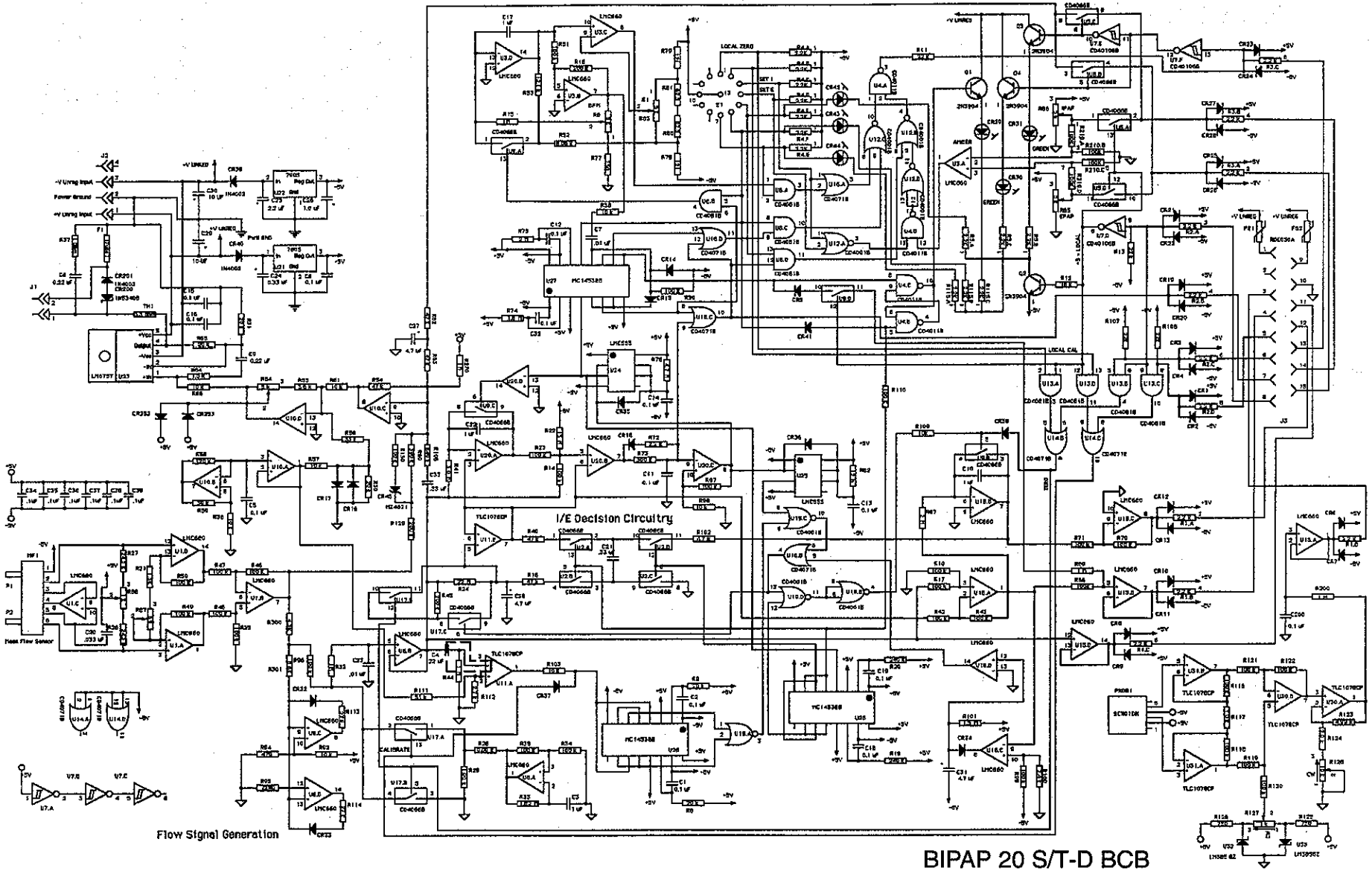

J1
8 PIN .100
SA
SB
SC
A
B
C
V+
Q7
MPSA13
D1
1N758A
C17
10uF
R6
4.7K
C1
.01uF
R16
50
R5
1K
R17
12K
C4
.01uF
C7
47uF
R20
FOR
FUTURE
USE
U1
MC33035
R12
F1
125mA
C3
.01uF
C16
.1uF
R21
10K
R9
10M
C2
.033uF
R10
75K
U2
MC33039
R11
6.2K
C8
.001uF
C9
.001uF
C10
.001uF
C6
1.5uF
D7
1N4148
D4
1N4148
C11
.01uF
R15
10K
J2
10 PIN .156
D2
1N4002
D3
1N4002
1000uF
C12
-V
C13
.1uF
C15
.1uF
C14
.1uF
D5
MR751
D6
MR751
C5
10000uF
R13
240
R14
240
R15
240
D10
1N5819
D9
1N5819
D8
1N5819
IRF9531
Q1
Q3
Q5
Q2
Q4
Q6
PS1
RUE250
PS2
RUE250
PS3
RUE250

BIPAP 20 MCB



BIPAP 20 S BCB


I/E Decision Circuitry
Flow Signal Generation
BIPAP 20 S/T BCB



BIPAP 20 S/T-D BCB

Appendix F: Changes

CHANGE: New Flow Transducer
New Main Control Board

AFFECTED: Blower Assembly
Manual Sections 7.5.3, 7.5.4

STATUS: In effect
Manual is changed

DESCRIPTION:

As of February, 1992, Respironics began using a new flow transducer/main control board combination. As a result, the flow transducer calibration differs for the different transducers. Two calibration sections (7.5.3 and 7.5.4) are now presented. You must identify the part number of the transducer in the unit you are calibrating, and select the appropriate procedure. The Test Equipment and BiPAP setups for the procedures are identical.

The old transducer number is 332046. The new transducer number is 332290. The board used with the new transducer does not have trimpot R91. You can find the transducer number on the Blower subassembly label located on top of the flow transducer.

ACCEPTABLE COMBINATIONS:

	Old Transducer, 332046	New Transducer, 332290
Old Board, has R91	OK	Caution*
New Board, no R91	OK	OK

*If the unit has been repaired and contains a new transducer with an old board, you may not be able to perform the flow calibration; the old board, in about 10% of the cases, does not have enough gain. If this occurs, Respironics recommends that you install a new board to ensure the successful calibration of the transducer, but you may try another old board.

CHANGE: New EMI Wraparound
New Main Control Board

AFFECTED: Wraparound
Manual Section 6.2.1

STATUS: In effect
Manual is changed

DESCRIPTION:

For S-D and S/T-D models with serial numbers less than 30000, you must replace the wraparound with Replacement Kit number 332345. The wraparound is an EMI-shielded wraparound. For S-D and S/T-D units with serial numbers greater than 30000, a new multi-layered board eliminates the need for the new wraparound. These models will use Replacement Kit number 332183.

Acceptable Combinations:

	Old Wraparound	New Wraparound
BiPAP S-D, S/T-D, S/N <30000	Replace with new wraparound	OK
BiPAP S-D, S/T-D, S/N >30000	OK	OK

NOTE: The old 332183 wraparound has a 3/4" square molded in the bottom. The new 332345 wraparound has both the 3/4" square and a 5/8" circle inside the square.

CHANGE: NewAC Inlet

AFFECTED: AC Inlet
Manual Section 4.2.3, 6.2.13

STATUS: In effect
Manual is changed

DESCRIPTION:

For units with serial numbers less than 150,000, you must replace the AC Inlet with Replacement Kit Number 332214. This AC Inlet has a fuse drawer with side clips for removal. For serial numbers 150,000 or greater, you must replace the AC Inlet with Replacement Kit Number 332556. This AC Inlet has a fuse drawer without clips and is filtered with a lug insulator.

CHANGE: Transformer Change
(Fuses, Transformer, MCB,
Voltage Selector Switch)

STATUS: In effect
Manual is changed

AFFECTED: Fuses
Manual Section 2.2 BiPAP System Specifications
Transformer - Manual Section 6.2.5
Motor Controller Board - Manual Section 6.2.3
Voltage Selector Switch - Manual Section 6.2.15

DESCRIPTION:
As of serial number 200,000 the BiPAP 20 units have been assembled using new fuses, transformers, motor controller boards, and voltage selector switchs. The new components are required for any repairs on units with serial numbers 200,000 or greater. Any units under serial number 200,000 must be repaired using the version of components that were originally used in those units.

Component	Serial Numbers <200,000	Serial Numbers > 200,000
Fuses- 115 VAC Applications	1A Fuses (PN 332120)	800mA Fuses (PN 362523)
Fuses- 230 VAC Applications	500mA Fuses (PN 332121)	400mA Fuses (PN 532163)
Transformer	PN 332180	PN 332554
Motor Controller Board (MCB)	PN 332172	PN 332553
Voltage Selector Switch	PN 332175	PN 332555

CHANGE: Muffler Change

AFFECTED: Muffler

STATUS: In effect
Manual is changed

Manual Section: 6.2.6 Muffler Replacement

DESCRIPTION:
Units with seial numbers greater than 80961 contain the new "tube" muffler. Replacement parts kits now contain the new tube muffler, which will replace the old square muffler. No adjustments are required to accomodate the new muffler.

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